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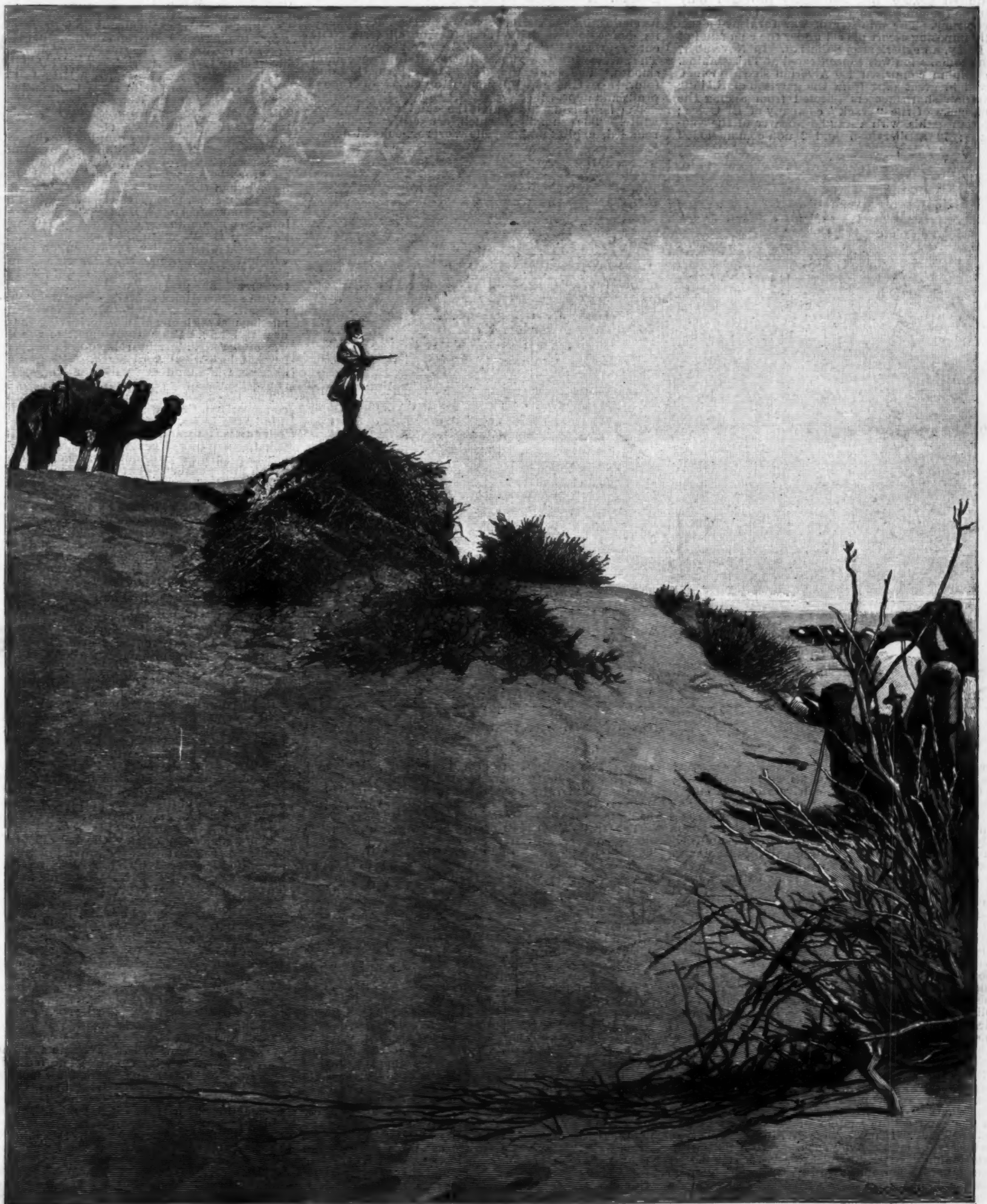


A VIDETTE OF THE FOUREAU-LAMY MISSION IN THE DESERT OF SAHARA.

THE CONQUEST OF THE SAHARA.

A FEW weeks ago, news was unexpectedly received of the occupation of In Salah. A short time before this, information had come to hand that the crossing of the Sahara by the Foureau-Lamy mission had been successfully accomplished, and that a brigade of engineers was immediately to enter the desert in order to study the direction line of a railroad 1,200 miles in length to connect Algeria with the Soudan.

THE FOUREAU-LAMY MISSION.

In the front rank of the promoters of this idea of the conquest of the Sahara must be mentioned the name of M. Fernand Foureau, who has for twenty years been exploring the northerly part of the desert and fever trying to push further toward the south. For the last ten years he has been endeavoring to organize a large expedition that should allow him to reach Aïr, and afterward the Soudan. After M. Renoust des Orgeries, who, in his old age had become deeply interested in great geographical problems, left his fortune to the Geographical Society "in order to help the organization of missions designed to contribute toward making a homogeneous whole of the French possessions in Africa," M. Foureau found himself to be the designated beneficiary of this liberality. He required $90,000, but the legacy provided only $50,000; so the minister of public instruction made up the deficiency. The minister of war furnished a sufficiently imposing escort placed under the command of Capt. Lamy, an experienced Saharian. In November, 1898, the commission was concentrated at Timassanine.

The column comprised 100 Algerian sharpshooters, borrowed in great part from the garrison of Blidah; 50 Saharian sharpshooters selected from among the best marchers of the "crack" company of El Golea; 20 Algerian spahis, with a standard-bearer of the commandant; 12 artillerymen and 2 non-commissioned

THE FOUREAU-LAMY MISSION IN THE GREAT ERG.

officers for the service of four Hotchkiss guns carried on camels' back; 50 Meharist spahis with a lieutenant; some Chambba guides; and the drivers of more than a thousand pack-camels carrying the necessary supplies.

At Timassanine, a station was established by the Meharist spahis of Lieut. Thezillab, and shelters for the storage of provisions were constructed of sun-dried bricks. Further, a small Bordj was built in order to protect the station against a surprise.

On starting from Timassanine, the mission grouped itself in order to move toward the south. An interval of but a few hours' marching was kept up between the various platoons. The service of revictualing was assured by the spahis of Timassanine, who, from the twenty-fifth of November, 1898, to the first of February, 1899, drove the pack-camels between their post and the successive encampments of the expedition.

The dryness was extreme in the regions traversed, and no rain had fallen for several years. The majority of the wells were exhausted, and the mission had to be supplied more than once with water brought in leather bottles from the artesian wells of Timassanine.

The routes of the Sahara are full of warnings. Upon the route of In Salah is located Oued-Aflisses, where Pallat was assassinated. In following the route of Aïr, we pass near Hassi-Tadjenout, where the Flatters mission was massacred.

The solitudes are peopled with enemies. One never knows whether or not a Chaf, a Targui spy, is lying upon the sand at the summit of the dunes that surround the camp. If he is, he is invisible, but he sees. If he observes that a convoy has come to a halt without stationing videttes, he quickly gives a signal that is transmitted from dune to dune; and suddenly there appears a band of pillagers, from whence nobody knows. There is no place in which it is more indispensable than in the Sahara to keep numerous sentinels on duty, although there is no place where they appear to be more useless. They never have any occasion to give an alarm, since from the moment that they are seen on duty, nothing stirs. But it is necessary for them to be there, like so many scarecrows.

Prudently, surely, convoy after convoy, one platoon behind another, a chain incessantly broken and then repaired, the Foureau-Lamy mission advanced into the more and more unknown part of the Sahara, through Erg, Hammada, and Reg—barbarous names that it is impossible to dispense with when it is desired to designate the various aspects of the great African desert. We have not their equivalent; and in order to express in ordinary language what their brief and sonorous syllables mean, it would be necessary to employ long periphrases that would render the same idea but imperfectly.

WHAT THE SAHARA IS.

The ground presents great variety in composition and aspect. It would be an exaggeration to claim that the Saharian landscapes are not monotonous. To the south of Algeria comes first the Great Erg, 360 miles in width. Every region of dunes is called "Erg." The Great Erg is the vastest. When we enter this, we meet in the first place only with low sandy promontories which spread, undulated and striated, over the calcareous carapax of the naked soil. Further on, the dunes increase in number and size. Sand is everywhere, and forms both the apparent relief and the mass of the ground. A complete orography is molded in this sand. There is Erg, properly so-called, with its hills, its chains, its counterforts, its declivities, its valleys, its depressions and its accidents of all sorts. The entire surface of the bottoms is slightly honey-combed. The surface of the slopes is wonderfully even and smooth. The top of the highest dunes—the Oghroud (plural of Ghourd), dominates a chaos of ridges, peaks and depressions.

The light is dazzling, and the sand never appears white. The summits, which are either sharp or rounded, exhibit orange yellow, or rose-colored reflections. The shadows are of a deep violet. Here and there are seen black spots formed by tufts of grass or shrubs. When the tufts of grass are not too widely spaced, the place where they grow is called a pasturage.

The trail (Medjebed) of the caravans through the dunes is clearly written in the sand, wherever the wind has not blown since the last of them passed. Even after a violent wind, the Medjebed is still to be seen in places where traveling is frequent. The feet of the camels pack the sand, their urine and excrement agglomerate it, and their teeth leave a mark in the sparse vegetation of the road.

The aborigines are endowed to the highest degree with a remarkable sense of direction. They are capable of distinguishing from each other dunes that to us look precisely alike, and recognize the highest of them from afar and use them as datum points.

It is popularly supposed that these masses of sand are incessantly in motion. In reality, the displacements produced by the wind are continuous, but not very perceptible. When the Chili blows, a yellowish dust is seen to fly from the crests. This dust, which is sand, is carried to a great distance; but one tempest restores as much of the material as another one has carried away, and so a balance is established. The volume of each mass, observes M. Flamand, in his notes of voyage, scarcely changes except as the result of exceptional whirlwinds or of feeble but constant actions. The wind affects merely the superficial strata, and modifies the undulations of the furrows only. As a whole, the chains of dunes are as stable as mountain chains. The largest of them have names that they received hundreds of years ago, and that they will continue to bear for ages to come.

A storm of extreme violence came down upon Timassanine in the month of December, 1898, and lasted three days. There was so much sand in the wind that the air was darkened by it, and the fine dust was hurled with violence against the adobe walls of the place. After the Chili had abated, the layers of accumulated sand were measured, and found to vary from 3¼ inches to 5 feet in thickness. But around the station, the outlines of the undulations of the ground had not undergone any perceptible alteration.

Marching in the dunes presents other difficulties than those that attend the ascertaining of one's bearings. A caravan, in order to surmount a hillock, selects a path midway between the top and bottom, in order to avoid too steep an ascent and descent. The men of the vanguard and the guides provided with mechara go on foot in traversing the sand—some of them barefooted, and others wearing Gourarian shoes, wide and light, and having felt soles. They walk a little to the front and upon the flank of the group of camels. The latter proceed with their usual calm step, swaying their head, and occasionally making a snap with their teeth at the too rare grasses that chance to be within their reach. When a passage presents itself where the soil is particularly loose, the intelligent animals stop and make a careful inspection of the place, for they know that if they pass in a body a slide might occur along the declivity. So they separate one after another, in order to cross the suspicious place one at a time.

Camels, the pack-animals especially, have a repugnance toward climbing, and a greater one still toward descending. When they are forced to approach a dune and to scale it, a battle almost always ensues at the summit between them and their drivers in the attempt to make them descend on the other side; and in order to maintain themselves in the horizontal, they obstinately turn to the right and left. The mechara pass more easily; and, as for the horses, they cheerfully climb hills and willingly descend them by sliding.

The caravans that traverse the Great Erg from north to south do not continually travel in sand, since the region of the dunes is traversed by the Gassis—wide and lengthy passageways running north and south.

The soil of the Gassi is the Reg—a stratum of gravel mixed with agglutinated sand, which forms the best of all grounds for walking. The Reg is the natural macadam of the desert.

In the median part of the Gassi, we frequently meet with what are called Daïas—low bottoms in which humidity accumulates, as a consequence of rains, and keeps up the vegetation. The Dhamran, which the camels eat with avidity, the Retem, on the flowers of which they browse, and the Zita, which is used as fuel, abound in this clayey or chalky soil; while the gum-trees reach fine proportions therein.

Other depressions contain deposits, of gypsum and rocksalt. These are the Sebkhas. The Foureau-Lamy mission met with one of them on leaving the Great Erg, near El Biodh. From the summit of the dunes there was observed what might have been supposed to be a frozen lake covered with snow. The ground was of a dazzling white, and every facet of the crystals of gypsum reflected a ray of the sun.

The black soil of Hammada is unfortunately more common than the red Reg strewed with white Sebkhas and fertile Daïas. Hammada is a desert within a desert. The soil is stony and full of cracks, ridges, and ravines. Gigantic terraces of conglomerates and pudding-stone, desolate surfaces without herbage, and alternately rough and polished—that is Hammada. The feet of the dromedaries and horses are made to bleed therein, and the felt soles of the Gourarian shoes are torn in a single stage of the journey by the sharp flint stones.

The plains of Hammada rise one above another. Here and there stand the Ghours—high rocks with strange forms that resemble ruins, fortresses and turrets.

Erg, Hammada and Reg—such are the three typical aspects of the Sahara. In all the regions, except that of Hammada, wells are met with. In Reg they mark in most cases the bottom of the Oueds (plural, Aoudia), those beds, or rather those valleys of rivers that no longer flow, except in the season of rain or subterraneously. The stratum of liquid is sometimes met with at less than 6 feet beneath the surface of the ground; but at other times it is found only at a depth of 130 or more feet.

The walls, which are lined with wood, increase as they descend in the form of silos. The lower part, which is four or five times greater in diameter than the orifice, constitutes the water chamber. Certain wells are distinguished externally by wooden uprights connected by a crosspiece fixed by means of cords. This crosspiece is provided with a rude pulley that permits of letting down and hauling up the Delous, or buckets made of goatskin held by a wooden hoop. Other and more improved wells are surrounded by a genuine curb of dry stones and clay and surmounted by a cupola like the chapels elevated in honor of a marabout.

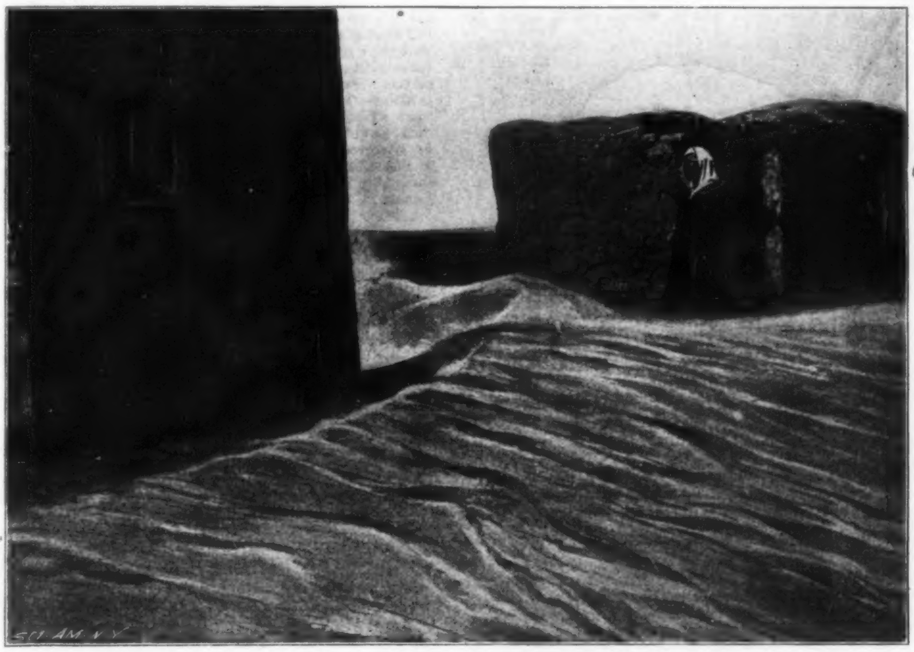
The wells of Erg occupy the bottom of the depressions. As the surface of the ground in which they are excavated is covered with a thick layer of sand, they have to be protected against the falling in of the latter. Their very narrow orifice is therefore hermetically closed by means of wide stones sealed through a mortar composed of sand and mud. Each caravan undoes the work in order to obtain water, and then carefully seals the well up again before departing.

RESULTS OF THE TRANS-SAHARIAN EXPEDITION.—In measure as it plunged deeper into the Sahara, the Foureau-Lamy mission reached higher altitudes and crossed greater eminences. But it was always successively Erg, Reg and Hammada. In Aïr only, which it reached at the beginning of the spring of 1899, did it find palm trees, running water, green meadows, orchards and cities.

For how long a time MM. Foureau and Lamy stayed in Aïr we do not as yet know. The most disquieting rumors as to their fate prevailed for months. While the bad news, which was false news, was spreading throughout Europe, the mission, ignorant of the dramas in which it was being mixed up, imperturbably pursued the execution of its programme. Its arrival at Zindar was announced in December last. It is thought to be at present upon the French bank of the Tchad.

Whatever be the rôle in store for the Foureau-Lamy mission in the region of Lake Tchad, whatever be the turns of fortune, of its return through Baghirmi and the Congo or Niger, it may be said that it has reached in the Sahara the result that it sought. It has obtained for itself the respect of the Touareg tribes; it has proved to the inhabitants of the oases, apprized of

its march, that the plundering nomads and ransomers, have found their masters; it has directly opened the gates of Agades and indirectly those of Ksar and El Kibir to France; and it has rendered possible the construction of the Trans-Saharian railroad. The conquest of the desert is more than half accomplished, since there is no longer anything mysterious about it.—For the foregoing particulars and the engravings we are indebted to l'Illustration.



A TEMPEST IN THE SAHARA—A SAND WAVE SURGING AGAINST THE WALLS OF THE STATION.

DR. DE MORGAN'S DISCOVERIES AT ANCIENT SUSA.

HALF a century has elapsed since Mr. Kennet Loftus, by his brief excavations, directed attention to the archæological importance of explorations on the site of ancient Susa. At that time nothing was known of the ancient and powerful Elamite kingdom of which Susa formed the capital, and little else than the remains of the palaces of the Achæmenian kings were expected. The position of the two great tumuli which mark the site of the ancient Elamite capitol, is of great strategic value. The larger of the tumuli is about 1,500 meters in length, and some 800 in its greatest width. The larger mound marks the site of the Achæmenian capitol, and at its northern extremity M. Dieulafoy uncovered the apadanas or palaces of Artaxerxes, Mnemon, and Darius, during his explorations in 1884-1886.

On his resignation of his post as director of the Gizeh Museum, M. de Morgan, says The London Times, was intrusted with a special scientific mission to make a thorough exploration of the site; the first results are made known in his report to the Minister of Public Instruction, and they fully justify the expectations that were formed. It is no misstatement to say that no explorations in Mesopotamia have produced such astonishing results or opened up so many new problems, not only as regards the historic ages of the Mesopotamian Valley, but in what has been entirely wanting—traces of prehistoric times. Of the staff, MM. Jequier, Lampre, and Gautier had worked in Egypt especially on primitive sites, and Father Scheil, a learned French Assyriologist, joined the expedition at a later period as expert. As Loftus and Dieulafoy had been unable to find any extensive pre-Achæmenian remains in the larger tumulus work was commenced in a smaller but loftier mound about 250 meters to the west. This mound rises to a height of nearly 100 feet above the surrounding plain, and presented every indication of being a more ancient ruin. On his arrival at Susa in December, 1897, M. de Morgan, who had previously visited the site in 1891, prepared for a thoroughly scientific exploration of the site, and here his previous training as a geologist stood him in good stead, as it had previously done in Egypt. The skilled explorer knows that in all ancient sites, especially in the East, the law of stratification holds good, and that to ascertain the various strata and their ages is the first task before the more minute examination can be made.

Starting with a base tunnel which revealed a yellow alluvial, he pierced the slope of the mound with five tunnels, until the first historic stratum was reached at a distance of about 7 meters below the upper surface of the mound. It was in the lower tunnels that most important discoveries were made in the finding of no less that three strata of prehistoric times. Here, as in all previously excavated stratified ruins, pottery afforded important data. The first stratum was 10·93 meters above the plain, and showed traces of a civilized people. Much pottery, remarkable for the fineness of its glaze and decorated with painted patterns in red, black and brown, was discovered. The patterns were chiely geometrical, but some had figures of birds resembling the prehistoric pottery from Nagada, in Egypt, and the early Greek work. In this stratum but few worked flints were found. In the next stratum, 14·30 meters above the base, the pottery was not so fine, mostly vases of rough earth, but the flints became more numerous, and here an important discovery was made. In many places heaps of small flaked flints were found which the explorer, from his Egyptian experiences, recognized as the flint teeth of sickles; and in the upper portion many such fragments were found with the bitumen adhering to them which had been used to seal them into the wooden frame of the sickle. It will be remembered that the Egyptian hieroglyph ma, a sickle, is colored at Medum and other sites as a wooden frame modeled from the ox-jaw in which flint teeth are set. Here, then, was a discovery which gladdened the heart of M. de Morgan. He had maintained in his work on "Researches on the Beginnings of Egyptian Civilization" that cereal growing was not indigenous to Egypt but had been introduced by an Asiatic race, who naturally brought with them the instrument with which to reap the crops. In the strata above, the remains of these implements were still more numerous and the teeth polished and worn from usage. Stone maces, one of the earliest prehistoric weapons, began to appear. Rising now to another stratum, 21 meters above the base line, we first find burnt bricks and traces of buildings, but no inscriptions whatever, and 4 meters higher the first town is discovered—the remains of the most ancient Susa, which in many respects resemble the lowest strata found by the American explorers at Nippur—but still no inscribed bricks. Above this, at a depth of about $4\frac{1}{2}$ meters, we come upon the ancient Elamite or Anzanian citadel, which was destroyed by Assurbanipal about B. C. 640.

Having ascertained the order of his strata, M. de Morgan entrusted the work of opening trenches to M. G. Lampre. After passing through 2 meters of Persian and Arab débris the Græco-Persian level was reached, which by enameled vases and coins may be said to cover a period of about five centuries from the Macedonian conquest to the rise of the Sassanian dynasties—that is B. C. 330 to A. D. 226. Below this the Elamite stratum was reached, and the remains of walls and pavements of bricks inscribed with the names of Elamite rulers—such as Kudur-nakhunta, Selkhak and Sutruk-nakhunta—were found; and from the amount of cinders and charred wood it became evident that this was the palace destroyed by Assurbanipal in his vengeance on Elam. The terrible destruction by fire and the deliberate raising of walls made it impossible to ascertain accurately the general plans, but many discoveries of great archæological importance were made. The walls were of square kilnburnt bricks (0·35 meters square), of bright brown color, those facing the interior being inscribed, so that the walls were covered with lines of writing. Along the walls were found many fragments of enameled bricks bearing inscriptions or decorative patterns, also portions of bricks with figures of men and animals used to form decorative panels. This mode of decoration had been familiar to us in its highest style in the Achæmenian palaces, as is shown by the splendid enameled brickwork found by M. Dieulafoy and now in the Louvre. Its use by the Elamite rulers in the eighth century shows us the source from which the Achæmenian artists derived their inspiration; there are many other indications of this influence of the older Susanian civilization. In the larger rooms the bases of columns were found, but from the large quantity of cinders and carbon around them, it is evident that these rooms had been roofed like the Persian apadanas.

We come now to the most important and astonishing discoveries of the historic period. Assurbanipal stripped the palace as far as he could and wrecked it, but there were certain monuments which escaped removal on account of their weight. Space will permit us to describe only one of these. Torn from its place and much injured by fire, the explorers unearthed a large stele of yellow limestone, which stood 6 feet 6 inches high and about 3 feet in width at the base. The whole face was covered by an elaborate sculptured tableau containing many figures. The work is most remarkable, both as a whole and in the details, and, although bearing every mark of antiquity, may compare favorably with the sculptures of Assyria. At the top of the stele are three solar disks with their rays. Below is a lofty cone representing the peak of a mountain, on the surface of which is cut a long inscription. Before this stands the king wearing a horned helmet and armed with an arrow or short spear in his right hand, a bow in his left. He wears a rich robe reaching to his knees and wears sandals. A dagger is thrust into his girdle. His beard is long. The royal warrior places his foot upon a dead foe, while before him another falls wounded, and tries to draw an arrow from his breast, and, further off, another personage is represented standing with his hands raised in supplication. The heap of dead beneath the victor's feet, in various complicated attitudes, is most remarkably drawn and carved. Below the king, mounting some steps, come three ensign bearers, each with the right hand placed on his dagger, and his left holding the banner. The ensigns are of considerable interest, as they are already familiar to us from the engraved gems of Chaldea—namely, the sacred lance, whip, and mace. Below the standard bearers come the soldiers variously armed. In front of these are two trees, behind which are the enemy, who are represented as turning round in supplication. From the whole tableau we see that it represents a campaign in a forest region, the enemy defeated and driven to the highest peaks, where they are slain or surrender to the victors. It is exactly the region of the dark pine forest of the hero Khumbaba, described in the Epic of Chaldea.

The question now is—of whose campaign is this remarkable monument a record? M. de Morgan, who appears not to have had the benefit of Father Schiel's expert evidences, regards it as Elamite; but the inscription upon it reveals the astonishing fact that it is a monument erected by Naram-Sin to commemorate his great campaign some time about B. C. 3750. How came it here? M. Maspero and Dr. Scheil seems to think that it was carried away from Chaldea by the Elamites, but considering the great size and weight, this seems hardly feasible. The more possible solution is that the stele had been set up by the Chaldean king either in Susa or in the region.

There was also found a large obelisk of granite, 6 feet in height, the four sides of which were covered with a long inscription of some 1,200 lines written in very archaic character. The text has not yet been

AFTER THE TEMPEST—THE SAND PILED UP AGAINST THE WALLS OF THE STATION.

published by Dr. Scheil, but it proves to be the record of a Chaldean king named Manistusu, of whom some inscriptions were found at Nippur.

[Continued from SUPPLEMENT, No. 1262, page 20228.]

SANTA ANA CANAL.*

By J. B. LIPPINCOTT.

TUNNELS.

ALL the tunnels on this division except one were intended to be of the same cross-section when finished, or about 6 feet 3 inches wide by 7 feet 6 inches high from invert to roof. The amount of excavation varied with the material, an allowance being made in each case to suit the thickness of the lining to be adopted. Some of the tunnels were through hard granite rock and were left in the rough; others were lined with concrete on the floor and sides; one was lined with concrete and roofed with brick (see Fig. 2); one, about 1,600 feet long, was partly lined with concrete and plastered on the invert and 1 foot in depth on each side.

The long tunnels, of which there are two, one about 1,600 feet and one about 1,400 feet, are on a grade of 2 feet per 1,000, and the shorter ones, of which there are seven, varying in length from 40 to 240 feet are on a grade of 1·75 feet per 1,000, the same as the flume. Much care was taken to keep the different parts of the waterway as nearly of the same capacity as possible, and where so many different forms of cross-section had to be adopted this was not an easy matter.

One of the most novel and extraordinary features of this work is the tunnel through the Morton Ridge, near the end of Division I. The ridge is a "hog back" of cemented gravel and bowlders rising abruptly about 250 feet from Morton Creek on one side and sloping off more gently on the other side to the mesa land lying between Santa Ana Canyon and Mill Creek. The tunnel is about 500 feet long, is of circular cross-section, 6 feet in diameter in the clear, lined with 3-inch planed redwood staves, backed with concrete, the latter being rammed in solid all around, between the wooden tube and the surface of the excavation. The peculiar arrangement of this tunnel is that it is on an upgrade in the direction of the flow.

There seems to be no reason why a tunnel similar to the others could not have been constructed through the ridge at much less cost, as the material was comparatively easy to work and good to stand until lined. It is evident that the intention was to keep the wood lining always wet, so as to preserve it, but this could have been done more easily and cheaply by simply excavating a rough tunnel through the hill and continuing the Morton Creek wooden pipe through it to a junction with the canal on Division II.

As this tunnel is at the lower end of the Morton Creek pressure pipe, it was necessary to have a receiving chamber of some kind to connect the tunnel and the pipe. As the tunnel was dropped at this end to keep it always full of water, a wooden penstock about 16 feet high was built close up to the tunnel. On one side it was connected with the pressure pipe, and on the other side with the tunnel by means of a funnel-shaped arrangement of wooden staves, gradually merging into the tunnel lining. This penstock is simply a standpipe on the Morton Creek pressure pipe. Silt is deposited here and is extremely hard to remove.

The only apparent reason for putting the tunnel on an upgrade in the direction of the flow was to keep it entirely below the hydraulic grade line from the inlet of the Morton Creek pipe to the outlet of the tunnel at Division II, and thus keep the pipe and tunnel always full of water to preserve the wooden lining.

Of course the tunnel could have been dropped bodily parallel to grade line, but this would have meant a box at the lower end more than twice the depth of the diameter of the tunnel. To avoid this and to keep the velocity of the flow as uniform as possible, an incline at the lower end was substituted for the box, which would have made considerable change in the velocity of the water.

To accommodate the Morton Creek pipe to the lower tunnel it was necessary to curve the pipe so much that the staves could not be bent, and a series of chords were made in the pipe to allow of its entering the penstock on a level with the tunnel. This is open to criticism, as the sharp angles would, when the pipe was running at its full capacity, entirely destroy the uniformity of flow which the pipe otherwise would have. At the lower end of the tunnel another piece of stave pipe on chords of sharp curve was tacked to the tunnel lining, apparently to save masonry work in lining the sides of the incline. This is also destructive of the uniformity of flow so carefully provided for in all other parts of the work, and extra expense and poor work were made necessary by putting the tunnel below grade. The penstock is exposed to the elements on a steep sidehill 150 feet above the creek, with 60 or 70 feet of steep ridge above it, and if it is not knocked down by a slide from above, which would bring disaster to the expensive pipe below, it will presumably rot in a few years.

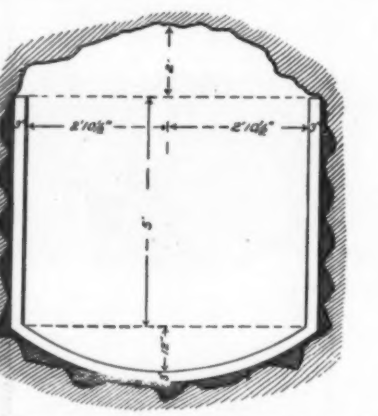


FIG. 8.—TUNNEL SECTION IN ROCK, SANTA ANA CANAL.

CONNECTIONS.

The connections between the different forms of waterway on this work are made in a very substantial manner. The change from flume to tunnel and from tunnel to flume does not require special mention, as the flume in each case is simply let into the tunnel about a foot and surrounded with a concrete wall bedded against the floor and sides of the tunnel (Fig. 2). No attempt was made to change gradually from one section to the other, as they were very similar and the slight difference in the calculated velocities did not seem to justify the expense.

In changes from flume to pipe, from pipe to tunnel, and vice versa, the difference in section was so great that a special chamber had to be designed to suit each case.

As there are three pressure pipes on Division I, there are six of these chambers; two from flume to pipe, one from pipe to flume, one from tunnel to pipe, and two from pipe to tunnel.

These chambers are designed with great care so as to avoid as much as possible any disturbance of the water. Five of them are well and substantially built of rough rubble masonry on concrete foundations and lined with cement plaster. One, from the Morton Creek pipe to the Morton Ridge tunnel, is a wooden penstock that has been already mentioned in discussing the Morton tunnel. The others, as well as the trestle supports under the pressure pipes, are designed to accommodate two pipes, although only one has been built. This was a needless expense and added to an already costly piece of work. Even if the company had been able to carry its land speculation business at Alessandro to a successful issue, it is hardly probable that the canal would ever have been enlarged, owing to the fact that, as later measurements have shown, the water supply was not nearly so plentiful as was calculated upon before this work was commenced. When the pipe sloped down suddenly from the flume the bottom of the chamber was made on a curve joining the lines of flume and pipe so as to offer as little resistance as possible to the flow of water.

In one instance a horizontal curve was made in the walls of a connecting chamber to accommodate the flow from pipe to flume. Great care was taken in the construction of the chambers, as they are all situated at places where an accident would be fatal to the pipes, which are laid on steep inclines below them.

SAND BOX.

There is at present only one sand box on the work, and that is a substantial and well built masonry structure, although it must be confessed that its capacity is very small for the amount of money it cost. It is about 60 feet long, 13 feet wide, and in the deepest part about 4 feet below the level of the flumes that enter it. The bottom part of this masonry box is cut up by cross walls and sloping floors into four prismoidal chambers with a sand gate in each. This class of sand box is mentioned in the description of the Crafton Canal.

POWER DROP.

There is one power drop planned on this work, but it has never been finished. It is at a point where the flume is at a height of about 350 feet above the bed of Santa Ana River, but had the intention of conveying surplus water in winter to the San Jacinto reservoir been carried out only a very small constant supply of water could have been relied on, because in winter only a small quantity of water is needed in the ditches to Redlands and Highlands, which this drop commanded.

SECOND DIVISION.

Division II of the Santa Ana Canal is about 3 miles long and is principally canal section, as shown in Fig. 9. There are about six gulches or arroyos on this division, crossed by flumes of the same form as those of Division I, but 12 inches deeper. These flumes aggregate about 1,500 feet in length. They rest on wooden trestlework, with bents 16 feet from center to center, and occasionally, where it is necessary to have a large waterway underneath, on 32-foot trussed girders.

There are two or three arroyos crossed with earth embankments having drainage culverts underneath. The intention was to allow these banks to settle for two years and then excavate and continue the masonry-lined canal through them. With this object in view, temporary rough wooden flumes were laid on these banks, of sufficient cross-sectional area to pass about 1,000 miner's inches of water for the Alessandro pipe line. These flumes have never been altered since laid in 1863, so that the actual present capacity of the Santa Ana Canal may be said to be only 1,000 miner's inches.

One short stretch of the canal has been finished to the full capacity of 12,500 miner's inches (see Fig. 9). This section is 12 feet 6 inches wide at the top, 7 feet 6 inches deep at the center, chord of invert 6 feet 6 inches wide, and versed sine 1 foot 6 inches. The lining was done with bowlders roughly broken to shape and laid in cement mortar. The walls were first built against the sloping sides of the excavation, which, being nearly all of the way in hard clay and cemented gravel, was made with side slopes generally of 2 on 1. The invert is simply paved and the chinks filled with coarse sand and spalls, with a layer of mortar roughly bedded on top, on which is laid the cement plaster lining. The walls are laid with more care to a rough surface and are from 8 to 10 inches thick on the top and about twice that thickness on the bottom.

As the material on this division is generally hard clay and the rainfall is very slight, there has been no trouble whatever experienced from the bulging or breaking of the walls from water lodging behind them, and the lined portion of the Santa Ana Canal is a very substantial and permanent piece of engineering work. The grade of this portion of the canal is very light, as a low velocity was necessary to prevent the wearing away of the cement lining by the sand and silt which is sure to find its way into the water, especially during freshets.

The calculated velocity for the full section is about 5 feet per second, that of the flume being about 10 feet per second. Careful provision was made for changing gradually from canal to flume section and vice versa. An examination of the two sections shown in the cuts will show that this was a difficult piece of work. The change from flume to canal was accomplished by building a wall across the canal, fitting the flume into this wall, and, by flaring or sloping surfaces of masonry, joining the edges the flume to the bottom and sides of the canal. The change from canal to flume was accomplished by narrowing the canal section for about 8 feet and then continuing the contraction by a wooden flume 16 feet long, which gradually changed from this reduced section of canal to the flume section. The purpose was to change section and velocity without loss of head.

This flaring flume was built on the same general principles as the flume, being composed of redwood staves, cut and fitted to effect the warping of the surface from a 2 on 1 slope in the canal to a vertical plane in the flume. These staves were connected and tightened by yokes and binders similar to those used between the T-iron frames on the flume.

It is unfortunate that the affairs of the company have been in such a condition that this canal was never finished, as this was one of the many interesting points where engineers differed and were anxious to see the results in actual practice.

MILL CREEK BRIDGE.

The most notable piece of work on Division II is the Mill Creek bridge. Mill Creek at the point of crossing is a wide and sloping wash of waterworn bowlders, cobblestone, and gravel, with occasional beds of sand. The water course, which, except in the times of flood,

* Extract from the Nineteenth Annual Report of the United States Geological Survey; republished by permission.

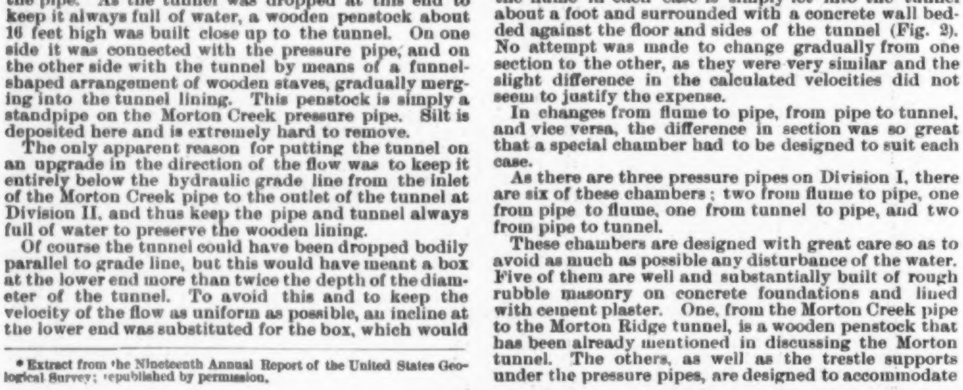


FIG. 9.—SANTA ANA CANAL, CALIFORNIA.

Capacity, 240 second-feet (12,500 miner's inches).

is only 10 feet wide and a few inches deep, winds through the wash, and the channel is liable to change in every flood. The flume, which is of the same section as the others on Division II, is supported by nineteen steel Pratt truss spans of 48 feet each, resting on braced steel trestle piers on concrete footings. The depth of the bowlder bed being unknown, these concrete footings are about 8 feet deep, resting on a foundation of redwood planks. The footings of each pier are connected and surrounded with a casing of redwood planks, which forms a box, and the space between the footings is filled with cobbles and gravel. The bridge is 1,072 feet long from end to end. The spans are in couples, and the piers are alternately a rocker and a pair of trestle bents 16 feet apart and braced on all sides, so as to form a tower, the flume being carried over this tower by a 16-foot span of the Fink type.

The bridge is a very light structure, but it is carefully and economically designed, and as it is riveted throughout (no bolts being allowed) is likely to last a long time if kept painted. The steel piers are latticed channel posts, braced and anchored to the concrete footings.

The flume on this bridge is an improvement on the other flumes, as the butts break joint, the clumsy wedge and strap arrangement is done away with, and a simple nut and bolt and large washer substituted. A continuous strip of hard wood is also substituted for the wooden wedges and blocks on the top of each side of the flume, on which each yoke bears directly. The consequence is that there has never been any trouble with the flume on the Mill Creek bridge.

The frames are supported by the floor beams, which consist of two channels, separated sufficiently to allow the rib of the T-iron frames to drop between them. A special cast iron chock is used under the frames in addition to the ordinary side brace, since the frame can not be let down into the channels, as was done in the case of the wooden sills on the other portions of the work.

This bridge and flume cost about $11 a running foot, and it seems singular that wooden pipe was not used instead. If one wooden pipe was sufficient for present purposes across Deep Canyon on Division I, there seems to be no reason why it would not have been more economical to use it in this case also, especially as it would have been under very low pressure, not to exceed 25 feet, and could have been put in, even doubled, for very much less than the cost of the bridge. Sunk 3 or 4 feet below the general level of the wash, it would have been practically safe from injury, as the tendency in all washes from the canyons in Southern California is to build up instead of washing out, and a wooden pipe filled with water would under these circumstances be practically indestructible.

COSTS.

The total charges against the Santa Ana Canal, including engineering, roads, trails, telephone lines, inclines, right of way, law expenses, etc., were about $250,000 for a length of 5·4 miles of conduit, or $8.76 per linear foot. This is a high price to pay for a canal, but it must be remembered that the first three miles of the work are in an exceptionally rough country, and that a great part of the expense was due to the connections necessary for the change from one form of cross-section to another. There are about forty of these connections on this piece of work.

The objection has been made that a good deal of money was spent in experimenting upon the work, but it was money well spent, and was trivial compared with the money actually thrown away by the loose financial management of the company's affairs.

Taken as a whole, the Santa Ana Canal is the best example in Southern California of a scientifically constructed conduit for the passage of irrigation water.

THE ELLIOTT AND HATCH TYPEWRITER.

THE machine which we illustrate, is intended primarily for typing direct into a ledger or day-book, though it can also be used for working on single sheets or manifolding. In fact, in the department of work last named the machine is particularly efficient, it being possible to secure as many as fifteen good copies by a single impression. This arises mainly from the fact that the paper is supported on a flat surface, and not a roller, and hence does not present a curved surface to the type.

In Fig. 1, we show the machine in position over a day-book. In passing from one impression to the next the machine is shifted bodily, in place of the paper as in the ordinary type of machine, and similarly in commencing a new line, the machine is advanced a space down the guides shown. The movement first named is accomplished by a space key in the usual way, while to pass to a new line the finger levers shown to the right of the machine are closed together and then released, thus operating a ratchet mechanism which moves the typewriter over one of the tooth spaces shown on the guide to the right.

FIG. 2.

FIG. 1.—TYPEWRITER FOR MAKING ENTRIES IN LEDGERS, ETC.

To reduce the weight of the machine as much as possible, a shift key is used in place of separate keys for the capitals and small letters. This shift mechanism is of very ingenious construction and will be easily understood on reference to Fig. 2, which represents one of the type-bars and the disk by means of which the change of character is secured. This type-bar has, it will be seen, a piece pivoted to its end, which at the lower side, is provided with two types (one upper and one lower case), and above has projecting from it a long finger, behind which is a locking spring as shown. When the disk shown is lowered by the shift key, this finger, striking on the disk, is moved round, so that the upper case character occupies the position previously held by the lower case character, and is accordingly impressed on the paper. On the return stroke its finger strikes against the inner side of a ring surrounding the disk and forming part of the frame of the machine, thus restoring the lower case character to this original position. When the shift key is not depressed the finger clears the disk on its downward stroke, and the lower case character is printed. The inking is effected by a ribbon as is common, and by moving this ribbon aside, by depressing a special key shown to the top and right of the machine, the characters last written can be seen without raising the keyboard. If it is desired to read the last sentence the whole keyboard can be swung up out of the way, this being facilitated by the pains taken to reduce the weight of the machine to a minimum. With this machine letters can be written direct into a letter book, the desired number of copies being simultaneously secured by manifolding.

The machine is the production of the Elliott and Hatch Typewriter Company, of 87 Gracechurch Street, London, E. C. We are indebted to London Engineering for the engravings and article.

AUSTRALIAN BRIDGE BUILDING.

THE Australian colonists, like their American kinsfolk, manifest a preference for doing things on a big scale whenever possible. In Sydney the citizens possess the largest organ and one of the largest town halls, in the world; while north and south of the city are two of the largest public pleasure reserves to be found in any country outside the United States. The Hawkesbury River, of which the people of New South Wales are as proud of as the famous Sydney Harbor, is spanned by an immense railway bridge, the largest of its kind in the Southern Hemisphere, and, as regards its foundations, one of the most remarkable in the world. The actual length of the bridge between the abutments is 2,900 feet, and it is supported by six piers,

each resting on a caisson filled with concrete and forming the most solid foundation possible. The caissons are respectively 101, 155, 146, 147, 144, and 162 feet in depth, these different measurements representing the inequalities in the depth of the river; the last-mentioned caisson being the deepest known foundation for a bridge. The main girders are 410 feet in length from center to center of bearings, the height of the principal girder being 58 feet above the surface of the river. The method of construction employed displayed considerable ingenuity. Each span was constructed on a large pontoon, 335 feet long, 61 feet wide, 10 feet deep, and provided with staging sufficiently strong to bear the whole weight of the immense mass of iron work, and high enough to enable the span, on the pontoon being floated at high water into position, to clear the tops of the opposite piers on which the guiders rested when finally in place. When the pontoon, which was provided with forty-four water-tight compartments, was complete with its staging, it was towed over a "gridiron" of piles and sills, in shallow sheltered water, and sunk, the exterior and interior valves being all left open, so that the water ran freely in and out at all tides. After the span was ready, the valves were closed, the water pumped out, and as the tide rose the pontoon floated and was towed into its destined position between the two piers on which the span was intended to rest. As the tide fell, each end of the span descended into its proper place, and the pontoon and staging, released from the ponderous load, floated back to the gridiron. The bridge was formally opened for traffic on May 1, 1889. The New South Wales government is now entertaining an even more ambitious idea, that of connecting the northern and southern shores of Sydney Harbor by a bridge, which, under any circumstances, must be one of the highest and longest in existence. Such a structure has become a pressing necessity, but although its importance has been recognized by successive ministries, that of which Mr. Lyne is the head has been the first to take practical action in the matter by offering a couple of prizes, one of £1,000 and another of £500, open to all the world, for the most suitable design for the required bridge. The designs must provide for two footways each 10 feet wide, two roadways each 20 feet wide, or one roadway 40 feet wide, also for a width of 24 feet in the clear for a double line of railway. It is considered that the bridge should be a single tier bridge, as the extra height to be surmounted by the railway or road, as the case may be, might be an objective, but designs showing either the footways or the roadway, or both, overhead, may be submitted, and will receive consideration. The bridge must consist of a single span, and a clear headway of 180 feet above high water, for at least the middle of 600 feet of its length, must be provided. The structure must be designed to carry a live load of 130 pounds per superficial foot of roadway and foot-path, and every part of the roadway is to be capable of carrying a moving load of 30 tons on two pairs of wheels, and for a train on each line of railway consisting of three of the heaviest class of engine and tender in steam, followed by loaded trucks. The engines and tenders to be taken as weighing 110 tons, with a length of 55 feet; and an axle load on drivers of 18 tons, the distributed load due to the loaded trucks to be taken as 1½ tons per lineal foot. The competitive designs will have to be delivered in Sydney not later than August 1, 1900.

TRADE SUGGESTIONS FROM UNITED STATES CONSULS.

Reform of the Swedish Consular Service.—Vice-Consul-General Hanauer writes from Frankfort, January 25, 1900:

The special commission for Swedish commerce and navigation is considering in what manner Swedish consuls can best be utilized to increase that country's export trade. Some months ago, the commission sent its secretary, a royal commercial counselor, to study the subject abroad. It is proposed to establish a mercantile information bureau, which is to give Swedish merchants the latest data about openings for Swedish products in foreign markets. This bureau is to collect information from Swedish consuls and from other available sources and communicate the same without delay to parties interested. It is also proposed to give consular aspirants a thorough training. The secretary recommends that foreign methods of training consuls be carefully studied. He especially points to Belgium, where consuls, before they are appointed, are obliged to travel in foreign countries and also examine industrial districts at home, in order to become familiar with the manufacture of goods intended for export; later, at the expense of the government, they make tours of investigation in countries where such goods are exported.

Duty on Mining Machinery for the Klondike.—The consul at Dawson City, Mr. J. C. McCook, reports, under date of Washington, February 7, 1900, as follows:

The Imperial Institute Journal, of London, in its issue of January, 1900, publishes a tariff decision of the Canadian Board of Customs, according to which elevators or floating dredges, used in mining submerged alluvial gold-bearing deposits, are to be admitted free of duty.

Working of German Law on Exchange Speculation.—In compliance with a request from a San Francisco editor, an instruction was sent by the department to Consul-General Mason, December 13, 1899, asking for information in regard to the working of the law to prohibit speculation in grain on 'change in Germany. The reply, dated January 6, 1900 (copy of which has been sent the correspondent), reads:

The statute in question was translated and fully described by Consul Julius Muth, of Magdeburg, in a report dated August 31, 1896, which was published in Consular Reports No. 194 (November, 1896), page 447. Its effect has been exactly what was intended, to prevent grain speculation in chambers of commerce and produce exchanges; but it is stated that such transactions are still carried on to some extent privately, the negotiations taking place in counting rooms, restaurants, and on the street. As there is no public or other definite record of these transactions, it is impossible to give any approximate estimate of their number or amount; but commercial men and journals generally agree that the law, while favoring to some extent the interests of the agrarians or agriculturists, has operated badly for Germany by throwing discredit upon what is elsewhere recognized as a legitimate form of trade, and thereby driving out of the country to Antwerp, London and Amsterdam dealings which would otherwise take place at Bremen, Hamburg, Berlin, Frankfort, Mannheim, and other German cities.

Greek Currants in America.—Consul McGinley, of Athens, under date of January 8, 1900, sends translation of a Greek newspaper clipping, which reads as follows:

The Grecian consul in Chicago has sent to the Minister of Foreign Affairs a very interesting exposé concerning the importation of currants into the United States from Greece. According to his report, both the Corinthian and California currants are on sale in Chicago. The former is far superior in quality; but the Californians by a special process clean their currants and extract the seed; and in Chicago they are subjected to another process of cleaning. They thus acquire a greater value than the Corinthian currants, which are for the most part mixed with sand and are unclean and filthy. The currant is used in cakes and sirup, and also as a separate article of food.

If it were possible to accustom the people to its use in the latter way, the demand for and consumption of the Corinthian currant would be considerably increased. Besides the relatively heavy tariff, which retards the importation of the Corinthian currant, an important reason for the small consumption is the lack of proper advertising of its merits.

The consul proposes to the currant merchants of Greece that they send to Chicago 50,000 liters (47,317 quarts) of currants of select quality packed in 200,000 neat pasteboard boxes for distribution, which boxes should be covered with lavish advertisements. The expense of packing, freight, tariff and distribution, he says, would not exceed $2,000.

Advice to Prospective Settlers in Mexico.—Consul Griffith, of Matamoras, writes, on January 27, 1900:

The colonization law of Mexico allows free entry of the effects of intending settlers only to persons who have acquired the legal character and status of colonists, and who come as such to settle in some colony established by authority of a concession granted by the Federal government. I make this suggestion, inasmuch as within the last two years several companies, with all their household effects, implements, horses, stock, etc., have driven from various sections of the Central States to the Rio Grande intending to cross over and locate in Mexico. In all these cases, they have either acted under the instructions of ill-advised persons or have expected the representative of the United States to arrange matters satisfactorily for them upon their arrival at the border, and it goes without saying that upon learning that the government of Mexico would allow exemptions only under the above conditions, they were embarrassed and usually dispersed after having undergone unnecessary hardships and a great deal of expense.

Electrical Development in Canada.—Electrical industries in Canada have fully shared in the prosperity now felt throughout the Dominion. According to The Canadian Electrical News, the leading manufacturing and supply companies report that the volume of their business for 1899 exceeded by upwards of 75 per cent. the business done during 1898. More than half the output of these companies was applied to the extension and improvement of existing plants, the bulk of the machinery sold being for lighting and power purposes. There was but little new railway-construction work done during the year, but a considerable amount of apparatus was required for extensions and improvements.

Improvement and development have been quite as marked in the commercial as in the mechanical field. The business done has been so large and so profitable that the stock of the two leading manufacturing companies has risen fifty points during the year, and further advances are predicted. The workshops of the electrical manufacturing companies are said to be crowded with orders to such an extent than no promise of delivery at a specified time can be made, and prices are firmly maintained.

The utilization of water power for the generation of electricity has been taken up with energy throughout the Dominion. This new medium of power transmission has made possible the harnessing of Canada's almost endless water powers, and the cheapened production resulting accounts in part for the rapid growth in Canadian manufactures.—Harlan W. Brush, Consul at Niagara Falls.

Irish Trade with Cuba.—Consul Touvelle writes from Belfast, January 24, 1900:

There is a pronounced improvement in the textile trade here, which is attributed to the reopening of the Cuban market. Prior to the Spanish-American war, manufacturers of linens were severely handicapped in the struggle to compete with Spanish producers for two reasons: first, the high import duties on entrance into Cuba, and, second, the cost of remitting in bills of exchange on London, which the purchasers in Cuba had to pay in gold, while remittances to Spain were made in Spanish currency, which cost much less. The result was that Belfast linens were driven out of the Cuban markets. Some of the merchants established factories in Spain in the effort to remedy this state of things, but without success. The result of the war, with the revised and justly executed tariff, alters the whole condition of affairs, and Belfast shippers are now able to compete successfully with Spanish or other foreign manufacturers. The improved condition of credit in Cuba is gratifying. It is remarkable that Cuban merchants have been through the year remitting promptly for their purchases, so that delay and difficulty are disappearing. To use the words of a local linen merchant, "All these things are surely a tribute to the wise, able, and enlightened government of that country by the United States."

Trade Openings in South Africa.—Consul-General Stowe writes from Cape Town, December 9, 1899:

While the representatives here of export commission houses in the United States are cabling large orders for foodstuffs, other supplies are wanted by the government. Contracts for the building of railroads, for supplying the army, jails, prisons, public and private institutions, etc., are open for bids. If our manufacturers, owing to the brisk home markets, do not care to compete at present, they might be prepared to do so after the war, when there will be a "boom." The country will then be short of supplies, particularly in the line of food stuffs, and in many other directions the demand will be large. Vehicles, tools, harness, etc., will be needed. The destruction of furniture and household supplies has already been large. Telegraphic and railroad equipment, lumber, clothing, hats—the countless things required by a country emerging from war—will find a ready market. It behooves our manufacturers and producers to be prepared to obtain a part of this trade.

Proposed Steamship Line to France.—A line of steamers to ply between Philadelphia and the ports of the River Loire—namely, Nantes and St. Nazaire—is now being seriously considered, says Consul Joseph I. Brittain, of Nantes. I am assured by those interested that enough encouragement has already been given the project to warrant its success. About two years ago, an effort was made to establish a line between Philadelphia and either Bordeaux or Marseilles; but on account of opposition from parties interested in the lines from New York to Bordeaux and Marseilles, the project is abandoned so far as the latter ports were concerned. At that time, the projectors of the enterprise received much encouragement from commercial organizations and business men of Philadelphia.

A glance of the map of France will convince one that the entrance to the River Loire is the most logical eastern terminus of a French line. Nantes is much nearer Paris than either Bordeaux or Marseilles. Here, vessels may discharge cargoes into the cars of two of the leading railroads of France, namely, the Chemins de fer de l'Etat and Chemins de fer d'Orleans. The largest ocean steamers may enter the harbor at St. Nazaire, and vessels of 4,000 tons may come up the River Loire as far as Nantes.

A line of coast steamers from Spanish and Mediterranean ports, as well as from ports of England and the north of France, will connect at St. Nazaire with the proposed Philadelphia line, which will be known as Le Compagnie Maritime de l'Atlantique.

At present there is no steamship line plying between Philadelphia and any French port, and the establishment of such a line would certainly benefit American commerce. Large quantities of merchandise comes from Philadelphia to France via Liverpool, thus increasing the tariff charges by indirect shipments and almost doubling the time in transit as compared with a direct service.

This department of the Loire-Inférieure has a population of more than 750,000, and the vast and varied manufactories along the river would, no doubt, afford a market for our raw material, such as coal, phosphate, petroleum, iron ore, and stave wood. American goods which have been introduced here find a ready sale and give good satisfaction, but the people naturally wish to see samples before making other purchases. If an effort were made, the United States could obtain much of the trade which now goes to England, Germany and Austria. Americans wishing further information regarding the proposed steamship line should correspond with Capt. François Berginal, No. 10 rue Gresset, or A. J. Gauin, 24 Quai de la Fosse, Nantes.

Demand for Phosphates in France.—Consul Brittain, of Nantes, under date of January 10, 1900, writes as follows:

M. Albert Brosseau, 4 rue Cambronne, Nantes, wishes to correspond with some of the leading wholesale dealers in phosphates in America; also with parties who handle phosphate made from slag by what is known as the Thomas process. M. Brosseau is an extensive dealer in phosphates.

Russian Tariff Reductions of Coal and Iron.—Vice-Consul-General Hanauer writes from Frankfort, January 19, 1900:

The St. Peterburg Gazette states upon good authority that the present tariff rates on coal, iron, and cast iron will soon be reduced, on importations destined for factories in the Baltic and St. Petersburg districts, within 100 versts (66 miles) of the coast line. There is a great dearth of coal in Russia, culminating in a severe crisis. Many of the industrial establishments in Lodz, the center of Russian manufacture, have had to stop work or reduce the operating force for want of coal. The prefect of this city telegraphed to the imperial governor of Petrikau to at once take energetic steps to give relief. Our American coal mining and shipping companies should seize the opportunity to inaugurate a coal export movement to Europe.

Tariff Changes in Dutch India.—Minister Newel transmits from The Hague, under date of January 25, 1900, translations of royal decrees dated December 30, 1899, one authorizing the governor-general of Dutch India to extend the operation of the old tariff law to the parts of the possessions not mentioned therin; another fixing the import duty on salt at 3·50 florins per 100 kilograms ($1.40 per 220·46 pounds) in the district of Tapanoli, and at 2 florins (80 cents) elsewhere. The last levies export duties on forest products in those districts lying outside of Java and Madura.

INDEX TO ADVANCE SHEETS OF CONSULAR REPORTS.

The Reports marked with an asterisk (*) will be published in the SCIENTIFIC AMERICAN SUPPLEMENT. Interested parties can obtain the other Reports by application to Bureau of Foreign Commerce, Department of State, Washington, D. C., and we suggest immediate application before the supply is exhausted

MISCELLANEOUS NOTES.

A wire rope is just like any other machine; it needs care and lubrication. The latter is important; as a lubricant it needs to penetrate all the wires, as a preservative it must be free from acids and must prevent rust, as a protection it should turn liquids and obviate abrasion. Linseed oil is not a good lasting lubricant; a better article is made of tar, summer oil and mica axle grease in varying proportions to suit varying conditions. The tar and oil must be free from acid. Well made, this compound penetrates the wires, prevents rust, and fills the cable, shedding water, keeping the core in good condition and adding 25 per cent. to the rope's life. The best way of applying this lubricant is by a small, steady drip, very slowly pouring in a fine stream while the rope is in use.—Mining and Scientific Press.

The effects of wire-drawing and annealing on the stress-strain diagram of steel wire have been studied by Mr. A. D. Keigwin, and the results given in the Proceedings of the Institute of Civil Engineers. The conclusions are: 1. Steel when wire drawn has its breaking load increased. 2. When the wire is annealed, the breaking load is lowered to that of the billet from which the wire was drawn; in this case an average reduction of 39 per cent. 3. The ratio of yield point to breaking load—36·7 and 31·8 per cent. for unannealed and annealed wires respectively—is lowered. 4. The ratio of the extensions at yield point and at breaking load in unannealed wire—viz., 0·25 to 0·75 per cent., is increased by annealing to 0·25 to 5 per cent. 5. The reduction of area of break is increased 16 per cent. by annealing. 6. The mean stress-strain diagram for annealed wires is a parabolic curve.

The United States Consul at Amsterdam says that battik is made in the Dutch East Indies by the natives, who decorate their clothing with it. A piece of linen is taken and all kinds of designs are outlined upon it with a pencil. When the design is completed, the ornamented parts of the fabric are covered with a liquid which possesses the quality of stiffening after being applied. The parts not ornamented are dyed the color desired. After the entire fabric has been ornamented in this manner, it is boiled in hot water so as to take the hard stuff out of the battik. The dyed parts will then hold the dye, and the battik is ready. People at The Hague were the first to introduce battik into Europe. It is made on linen, silk, velvet, and leather, and is exported to all the principal cities of Europe. Orders have been received from the government to decorate the Netherlands department of the Paris Exhibition in battik.

T'ung oil is extracted from the seed of the paint tree (*Dryandra cordasa*), which, according to the United States Consul at Shanghai, is extensively cultivated in the Yangtze Valley, also in Chekiang Province. The seeds of the paint tree are poisonous, and the oil is used occasionally for poisoning rats, also to produce vomiting in would-be opium suicides, though for the latter purpose it is neither so safe nor so effective as zinc sulphate or the stomach pump. The chief use of t'ung oil is as a standard paint, and as such it is in great demand by the natives. When boiled it makes one of the best drying oils; it is also extensively used in varnishing with the famous Ningpo varnish "t'si," i. e., the dried sap of the varnish tree (Rhus vernicifera), a good coating of which will stand considerable heat without leaving a mark, and will last for years. The various shades for coloring are produced by animal, vegetable, and mineral substances. Pigs' blood is the favorite for a first coating in varnishing. To give body and luster to paint they mix with the oil finely powdered galena and other ores.

Messrs. Illing & Burkart, of Zwickau, have brought out a machine designed especially for cutting rubber, and is equally suitable for cutting such materials as celluloid, felt, asbestos, and wax cloth. Although apparently only a knife device, it differs in this respect that the lever does not turn on a simple pivot, but is guided in slots. A slot bearing is fixed to both sides of the table so that the cloth under the knife cannot shift laterally. The cut is therefore always in a vertical line, and at the same time diagonal, as in large paper-cutting machines. This arrangement holds the cloth firmly; but a modification of the machine, whereby a press and cutter are combined, accomplishes this object still more effectually. The device is simple. The journal glides in slotted bearings, and a toothed arc of 180° is fixed to the end of the lever. This arc engages with a vertical rack, guided in the frame of the table, so as to glide up and down. The depression of the lever knife raises the rack, which in its turn urges the press downward. The material is thus always under pressure when being cut, and no adjustment for height is needed.

Mr. C. E. Stromeyer, M.Inst.C.E., recently read a paper on the origin of granite at Manchester, Eng. The lecturer attempted, says The British Architect, to explain the seeming paradox in granite and similar rocks, that the felspars, hornblendes, etc., must have crystallized before the quartz surrounding them, although the melting point of quartz is much higher than that of the other minerals, the difference being as great as that between the temperatures required to melt ice and lead. The author suggested a possible method of freezing water or felspar while the one is in contact with molten lead, and the other with molten quartz, one of the most infusible substances known. The explanation is based on the theoretical deduction of the late Mr. J. Thomson, and verified by experiment, that the melting point is altered by pressure, rising in some cases and falling in others. The fact that the melting temperature of ice falls under pressure is the explanation put forward by Prof. Osborne Reynolds, of the slippery nature of ice, his view being that the pressure of the skate melts the ice along the blade. The rate at which the earth's temperature increases below the surface is fairly well known, and it is estimated that at depths of from 50,000 to 200,000 feet the melting points of both quartz and felspar will be reached, and at these depths the pressure exceeds even that in gun-barrels due to powder explosion. This great pressure must cause a considerable change of melting temperature in the constituents of granite, and it was suggested that certain experiments which were indicated be made to determine the amount of such changes.

TRADE NOTES AND RECEIPTS.

Production of Saddle Soap.—Dissolve 5 kilos of best yellow palm soap and 0·25 kilo of gelatine in 30 kilos of water, with constant stirring, and pour into tin cans.—Neueste Erfindungen und Erfahrungen.

Preservative for Leather Soles.—Grind 50 parts of linseed oil with 1 part of litharge, next dehydrate with ¼ part of zinc sulphate, and heat for two hours to 100° C. After the cooling, add 8 parts of benzine.—Organ für Oel-und Fetthandel.

Fire-Proofing Stage Decorations, Tent-Awnings, Etc.—Impregnate with a solution of ammonium sulphate, 14 kilos, ammonium carbonate 1 kilo, ammonio boracic acid 1 kilo, borax 3 kilos, glue 2 kilos, in 100 liters of water.—Kolonialwaren Zeitung.

Improved Imitation of the Gums.—In order to impart a more natural appearance to the rubber employed in imitating the gum for artificial sets of teeth which heretofore exhibited a uniform pink-colored surface, W. Bruns, of Brandenburg, Germany, adds to the crude rubber together with the pink dyestuff, or, to the dissolved rubber already tinted, a sufficient quantity of flesh-colored silk threads, before the vulcanization. The bright silk fibers incorporated with the rubber and showing through on the surface create the impression of a veined texture, such as is peculiar to the gums.—Neueste Erfindungen und Erfahrungen.

Japanese Bronzes.—Most castings which come here from Japan, are cast in a mold used only once. The casting of vases, which are chiefly concerned, is usually performed in loam molds with wax melting, as against the sand mold which is principally used by us. The author describes more fully the casting of a vase in its various stages. The Japanese bronze alloys differ from ours frequently by an exceedingly high percentage of lead, whereby the formation of a handsome patina is promoted at the expense of the strength of the bronze.

The following table shows the material differences between Japanese and European bronze alloys:—

	Copper.	Tin.	Zinc.	Lead.
Modern Japanese bronze alloys.	81·62	4·61	—	10·21
" "	76·60	4·38	6·53	11·88
" "	88·55	2·42	3·2	4·72
German and French bronzes...	86·6	6·6	3·3	8·3
" "	91·40	1·70	5·35	1·37

Sometimes, a trifle of antimony is still added to the alloy shortly before the casting, as is shown by the following composition:—

Copper.	Tin.	Zinc.	Lead.	Antimony.
68·25	5·47	8·88	17·06	0·34

The percentage of lead here is enormously high; the consequence was always a magnificent patina, and a very poor cast with many burnt places and holes as large as pins which, however, were very cleverly covered up.—Walter Elkan, in Chemiker Zeitung.

Staining and Waxing of Carvings.—If any one wants to prevent too much swelling of the wood after the staining, the wood should be given such smoothness before the treatment that it might be taken for polished. For this purpose take a wad of very thin soft shavings and polish the surface with a firm pressure of the hand until a faint luster appears.

Fine varieties of wood should not be stained. Walnut, pear, oak, plum and mahogany retain their natural color and are only waxed and painted with bruneleine and subsequently brushed, whereby they attain a somewhat darker tone and antique appearance.

A handsome dark-brown shade on walnut is obtained by first painting the wood with linseed oil—alkanna and polishing after 24 hours. Boil ¼ liter of linseed oil with a handful of alkanna in a pan over a moderate fire; a red liquid results, which is carefully poured off. The rule in staining is, the firmer the wood the stronger is the action of the stain.

The best and simplest method of staining is as follows:

Prepare two concentrated solutions, in two flasks of medium size, one of potassium permanganate and one of potassium chromate. The solutions are left to stand for a day. To do the staining take two dishes with clean water and add to one three-sixths drops of the permanganate solution, and to the other the same quantity of the chromate solution. Both solutions should be stirred well, and after that the wood is first coated with the chromate solution, and when this is dry, with the permanganate solution.

In this manner all woods, from the hardest to the softest, can be stained in the handsomest hues imaginable. To be on the safe side, a trial may be made on a separate board. If intenser shades are desired, the solutions should be made stronger. After staining with the potassium permanganate the brush should be quickly washed out in water, because this salt readily destroys the bristles.

An antique shade on oak is obtained by staining with umber, which has been boiled in water with very little potash. Wood stained in this manner still requires a coating for protection against the air. It is not polished, but receives a covering of limpid varnish.

Generally the carved objects are waxed, benzine wax being preferable to turpentine wax for this purpose. Same is prepared as follows:

Put small pieces of white wax in a well-closing vessel, pour enough benzine over this that the wax is covered by it (care is required, as benzine is very inflammable), close the vessel and leave it stand for a day in a cool place. A thick paste will form. Take a little of this out with a knife or spatula and dilute it with benzine in a flat dish to about the consistency of milk. Into this liquid dip a moderately soft bristle paint brush, and carefully coat the whole carved work. Leave it alone for a few minutes and brush out all the corners and cavities with a good bristle brush. A faint luster will appear. This wax does not clog the fine lines and notches, as is frequently the case if turpentine wax is used.

If it is desired to dye the wax red, add a little of a solution of alkanna in benzine. An addition of Prussian blue, dissolved in benzine, will impart a blue color to the wax. Cassel brown gives a mahogany color. After use, clean the brushes, etc., with hot soda solution.—Zeitschrift für Drechsler.

SELECTED FORMULÆ.

Liquid Polish for Metals.—

1. Prepared chalk	2	ounces.
Water of ammonia	2	"
Water, enough to make	8	"
2. Prepared chalk	8	ounces.
Spirit of turpentine	2	"
Alcohol	1	"
Water of ammonia	2	drachms.

Pastes for Mounting Photographs.—

1. Gelatin	4	ounces.
Water	16	"
Glycerin	1	"
Alcohol	5	"

Dissolve the gelatin in the water, then add the glycerin, and lastly the alcohol.

2. Arrowroot	1	ounce.
Water	10	"
Gelatin	48	grains.
Alcohol	1	ounce.

Soak the gelatin in the water, add the arrowroot, which has first been thoroughly mixed with a small quantity of the water, and boil four or five minutes. After cooling, add the alcohol, previously dissolving in it a few grains of salicylic acid.

3. Best Bermuda arrowroot	1¾	ounces.
Shellac gelatin or best Russian glue	80	grains.
Water	15	ounces.
Alcohol	1	"

Put the arrowroot into a small pan, add 1 ounce of water and mix it thoroughly up with a spoon, or the ordinary mounting brush, until it is like thick cream; then add 14 ounces of water and the gelatin broken into small fragments. Boil for four or five minutes, set it aside until partially cold, then add the alcohol, previously dissolving in it a few grains of salicylic acid. Be very particular to add the spirit in a gentle stream, stirring rapidly all the time. Keep in a corked stock-bottle and take out as much as may be required for the time.

Brass Polishing Paste.—

Powdered rotten stone	4	ounces.
Oxalic acid	1	"
Ferric oxide	1½	"
Oleic acid	1½	"
Stearic acid	1	"
Paraffin oil	1½	"
Oil of mirbane	1	drachm.

Melt the stearic acid in the oleic acid with a gentle heat; remove from the fire and then add the other ingredients.

Soap Powder.—

Powdered curd soap	6	pounds.
Oil of bergamot	4	ounces.
Oil of lemon	1	"
Oil of orange peel	½	"
Oil of fennel	½	"

Blackboard Slating.—

Shellac	8	ounces.
Lampblack	1½	"
Ultramarine	3¼	"
Rotten stone	4	"
Pumice stone	4	"
Alcohol	4	pts.

Dissolve the shellac in the alcohol, and add the other ingredients, in fine powder. Shake well before using.
—Druggists Circular.

Substitute for Ground Glass Stoppers.—Corks that have been steeped in vaseline are an excellent substitute for glass stoppers. Acid in no way affects them and chemical fumes do not cause decay in them, neither do they become fixed by a blow or long disuse, which latter fact will be appreciated by those who often lose time and temper by a "beastly fast stopper." In short, they have all the utilities of the glass without its disadvantages.—National Druggist.

Photographic Mounting Paste.—The Monthly Magazine of Pharmacy gives the following:

Arrowroot	3½	ounces.
Gelatin (Nelson's No. 1)	100	grains.
Alcohol	2	ounces.
Carbolic acid	12	minims.
Water (cold)	30	fl. oz.

Mix the arrowroot into a stiff cream with a portion of the water, while the gelatin is placed to soak in the remainder. When the latter is perfectly soft, and the arrowroot well mixed, pour all together into an iron saucepan, and bring to the boiling point, keeping at this point for about five minutes and stirring constantly to avoid burning. Then cool, stir in the acid previously dissolved in the alcohol, and mix well; bottle, and keep well corked.

Antiseptic Gauzes.—E. Debuchy employs the following formulæ in the preparation of antiseptic gauzes:

Carbolic Acid Gauze.—Phenol, 255; alcohol (90 per cent.), 1,500; glycerin, 20; purified gauze, 1,000. This gauze will contain 20 per cent. of phenol; it keeps supple and fresh provided it be stored in air-tight boxes.

Iodoform Gauze.—Purified gauze, 2,500; glycerin, 50; ether, 3,000; iodoform, 283 or 637, according as a 10 or 20 per cent. gauze is required. Ether alone is found to give better results as a menstruum than the mixture of ether and alcohol generally used, since the drying is more rapid, and, therefore, the time of exposure to the air reduced to a minimum. The gauze should be dried in a dark place and stored in air-tight boxes.—Journ. de Pharm. [6], 11, 1.

Cleaning Polished Wood.—A good encaustic, which will clean and polish at the same time, may be made from wax, sal soda, and any good soap. The wax and soap should be shaved and dissolved in boiling water. Stir frequently and add the soda. Put the mixture in something which may be closely covered, and stir constantly until cool. This may be applied to floors, furniture, marbles, tiles, bricks, etc. It will remove ink from polished surfaces. The French use white wax on white marbles, but this is not absolute necessary.

THE MÜGGELSEE IN WINTER.

To the east of Köpenick, near Berlin, lies the Müggelsee, a sheet of water four square miles in area, easily reached from Berlin by boat, rail, or carriage. The Müggelsee is merely an enlargement of the river Spree, forming a lake, which, though situated in a comparatively flat country, is not without a certain beauty. In winter time, when the ice has formed and the surrounding woods are covered with frost, the Müggelsee is a scene of life and gayety. Ice boats of all conceivable sizes and shapes are seen, from the crude triangular sled rigged with a mast and sail to the specially designed racing-boat. Besides ice boats there are countless skaters and ice-sailors who handle their sails with a skill born of long experience.

Our illustration has been taken from Illustrirte Zeitung.

VEHICLES OF THE WORLD.

THE emancipation of the horse, and its passing as a beast of burden, is one of the important features of the incoming century. Many automobiles are being ordered by women for the coming season, and a knowledge of their management is regarded an essential by all horsewomen.

There is a growing desire for lightness in automobiles, as well as in other carriages for women. Many of the new models that are shown, exhibit this in a marked degree. The basket phaeton, that won so great popularity twenty years ago, will be in evidence again next summer. The basket work, of one that was ordered by a woman recently, is of brown, while the wheels are carmine. Others are appearing in greens and yellows.

The presence of the automobile in England, made it necessary to protect the life of the Queen and her family by familiarizing all the horses of the royal stables with the modern innovation. In the first lesson, in the three stable yards at Windsor, the horses were led and then driven, around a motionless automobile. When they had become accustomed to its appearance, another lesson was given. This taught them what to expect of an automobile in motion, the horseless carriage being driven around them. In the third lesson the automobile was driven between them when they stood close together. A pure bred Arab stallion is said to have shown the least concern of all.

While American women are riding in light victorias, comfortable broughams and pretty phaetons, the women of India are still going about in pagoda-roofed, two-wheeled droschkes, which, like their Colicut cab, is drawn by sacred oxen on state occasions. The tonga of India, with a little aid of imagination, may remind one somewhat of the opera cab or hansom, which is gaining in popularity here. Unlike the opera cab, however, the tonga has but two wheels, and is a sort of tip-tilted affair with a gable roof.

The Valencia cab, with its white hood, which is employed by the dames and duennas of Spain, in going from one hamlet or city to another, reminds one somewhat of the American prairie schooner, the conveyance of the early settlers to the confines of the western world.

A fondness for going, and a love of riding, are probably shared by women the world over. Whether locomotion be confined to dog sledges or Lapland sleighs, that jolt over frozen plains, to the jaunting car of Ireland, the tourist car of England, the Spanish and Swiss diligences, the basket phaetons or the light automobile of the American, a ride is still a ride, and one of the choicest pleasures in the world.

The earliest known vehicles are the chariots of Egypt, and their first record is left in the book of Genesis, where Pharaoh commands his Prime Minister in these words: "Take you wagons (chariots) out of the land of Egypt for your little ones and for your wives and come." Seventeen hundred years after the clumsy uncomfortable "wagons" of the Egyptians bore the Israelitish women and children from Egypt, a writer leaves the following unhappy description of the Roman car of his time.

Those who travel fast would rather ride on horseback, than sit in a car, on account of the annoyance of baggage, the weight of vehicles, the clogging of the wheels, the roughness of the track, the heaps of stones, the projecting roots of trees, the streams on the plains and the declivities of the hills.

There is a long step from the Grecian woman's chariot, which Homer described as a springless, jerky affair, and the swiftly gliding, luxuriously upholstered automobiles of my lady of to-day. In the course of the evolution of vehicles none were more curious than that of the movable house of the Scythians, which consisted of a strong flat floor, on the sides of which poles were inserted and around these the skins of animals drawn. On some of them the poles were arched, and when the matting was spread over they had the appearance of old-fashioned beehives made of straw. As they moved across the plains seeking pasturage for their cattle, the women within pursued their domestic employments. It is said by Herodotus, that certain Amazonian women refused offers of marriage from Scythian men because of this mode of living.

In 1294 A. D. an ordinance issued by the King of France to suppress luxury, forbade the wives of citizens to use carriages, under fear of severe penalties. Probably the oldest representation of a Gallic carriage is to be found in a paper in the British Museum which bears the date of 1347. This "charriette" was an open kind of wagon, with side curtains rolled up. It was driven by a mounted postillion and drawn by two horses. The woman herself sat sideways, while her two attendants, evidently maids, were seated with their faces toward the horses. Previous to this time, and for many years afterward, litters and sedans were in common use among Continental nations. Isabella of Bavaria made her entry into Paris in a litter, in 1399.

Litters are still in use in some parts of the world. The traveler who would traverse the most dangerous mountain passes of Persia must do so in a tachtravan, a little wooden structure with a curved roof borne on poles, carried by two donkeys, one of which pulls and the other pushes.

The luxurious carriage of the desert is the palanquin, which is borne by camels. The palanquin that is used in India is carried upon the shoulders of four or six men. It is a sort of box about 8 feet long and 4 feet wide, and is similar to the sedan. In Japan it is called the norimond, and in China the kiaotsu. It is employed only where manual labor is plentiful and cheap.

The passenger barrow of China, with its one wheel requiring expert ridership to balance, is evidently the connecting link between litters and wheeled vehicles.

According to an old authority, coaches were first introduced into England in the reign of Queen Elizabeth, but in an old ballad of the time of Edward I. (1272-1307) occurs the following reference to them:

She was the first that did invent
In coaches brave to ride;
She was the first that brought this land
To deadly sin and pride.

The ballad bears the following quaint title:

A Warning Piece to England Against Pride and Wickedness, being the fall of Queen Eleanor, wife of Edward First, King of England, who for her pride, by God's judgments, sunk into the ground at Charing Cross and rose at Queenshithe.

An old print represents "the state procession of Queen Elizabeth to open Parliament on April 2, 1571." This was the first occasion on which a state coach had ever been used by an English sovereign, and it was the only vehicle in the procession on that occasion. William Boonen was Queen Elizabeth's coachman.

In 1582, the English embassador at the Court of France wrote to Elizabeth, saying:

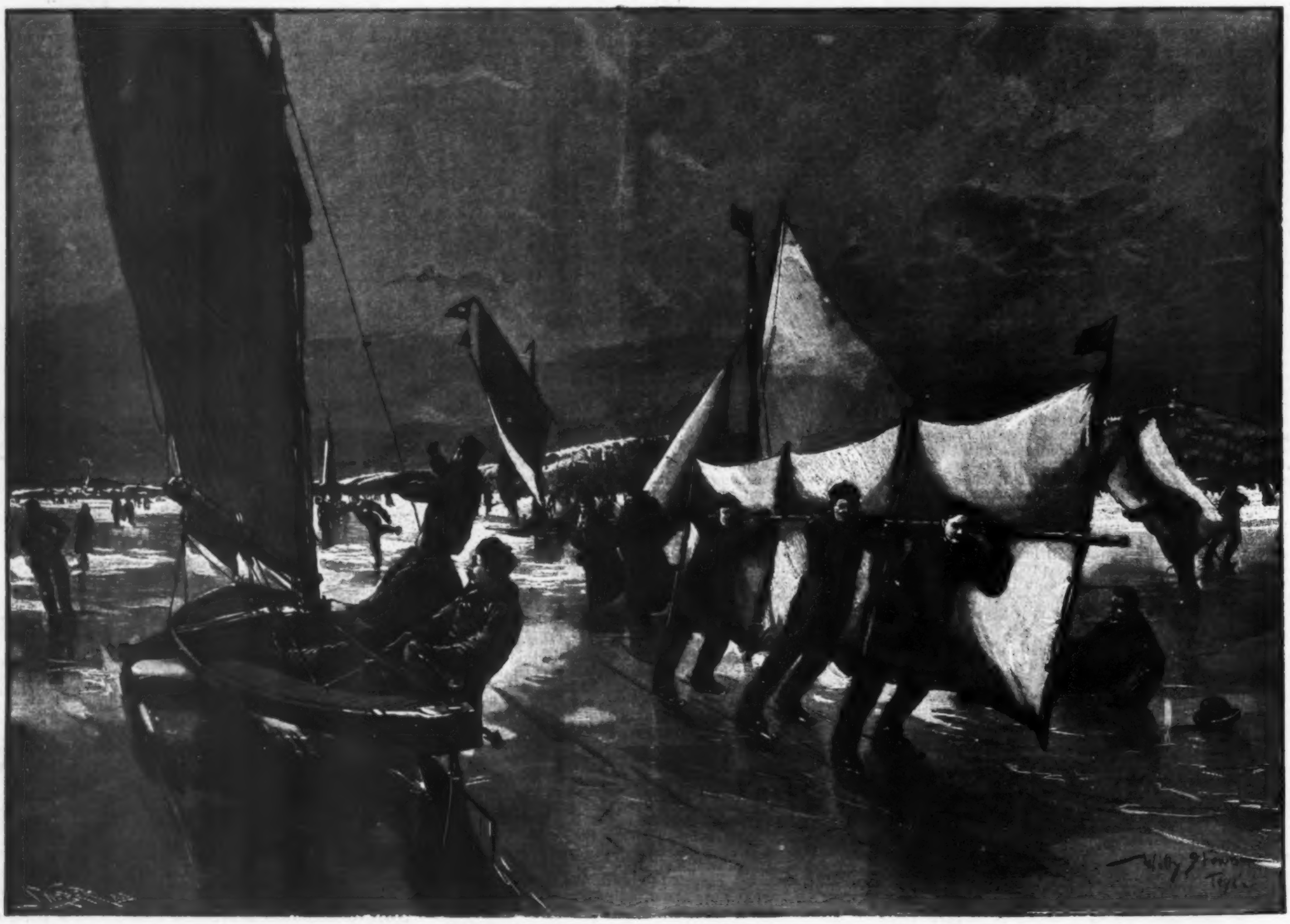
The French King hath commanded to be made for Your Majesty an exceedingly marvelous princely coche and to be provided foure of the fairest moiles which are to be had, for to carry Your Highnesse's litter. The King hath been moved to shew himself in this sort grateful to Your Majesty on receiving those dogs and other singularities you were lately pleased to send unto him for his falconer.

It is said that during this reign it was considered as much a disgrace for a young man to ride in a coach, as it is now for him to appear in woman's apparel, carriages being considered a feminine perogative. A writer of a few years later leaves this record:

After a while divers great ladies, with a great jealousie of the Queen's displeasure, made them coaches and rid in them, up and downe the countries, to the great admiration of the beholders.

As late as the sixteenth century, women often appeared on horseback on public occasions, for although carriages of a primitive kind existed, they were by no means commonly used. The use of coaches increased rapidly after this time, and upon one occasion, in 1668, it is said that there were one thousand coaches at one time in Hyde Park, London.

There are said to have been but two or three coaches in use in Philadelphia at the beginning of the eighteenth century; an old Pennsylvanian, who died about



WINTER SPORTS ON THE MUGGELSEE NEAR BERLIN.

1800, said that he could remember when there were only eight four-wheeled carriages kept in all the province. Mention is made of the trial of springs in Pepys's Diary under the date of May 1, 1665.

Only six stage coaches were running in England in 1762, and they were the only public means of traveling. Even these were considered so great a novelty, that a man by the name of John Crosset, issued a pamphlet which set forth in these words the danger with which public morals were menaced by them:

These coaches makes gentlemen come to London upon every small occasion, which otherwise they would not do except upon urgent necessity. Nay, the conveniency of the passage make their wives come often up, who, rather than come such long journeys on horseback, would stay at home. Then when they come to town they must be in the wade, get fine clothes, go to the plays and treats and by these means get such a habit of idleness and love of pleasure, that they are uneasy after.—N. Y. Tribune.

THE SERVICE BUILDING OF THE PAN-AMERICAN EXPOSITION.

THE service building of the Pan-American Exposition, to be held at Buffalo, N. Y., on the Niagara frontier, from May 1 to November 1, 1901, was the first building of the Exposition to be erected, and is used by the corps of officials and employees having direct charge of the constructive work of the Exposition.

The building, which is situated on the west side of the grounds, is 95 × 145. It is the form of a hollow square, having two stories on its exterior façades and three stories on the court side. The entrance, which is in the form of a driveway, faces the north and communicates directly with the inner court. Part way down this entrance and from each side extend the main corridors. That on the right leads to offices and apartments to be used for police headquarters and hospital service, including the rooms for the use of the commandant of police, police station, the chief of the fire department, medical waiting room, drug supplies, offices for a surgeon and his assistants, and an operating room. The hospital has a porte cochere entrance for ambulance and emergency purposes.

The other portions of the first floor are taken up by a large room for the officers and clerks who have charge of admissions and collections and the auditing of accounts, these rooms being fitted with fireproof vaults.

The working offices of the director of works, with his private office and stenographer's room, offices for the landscape architect, the superintendent of the building construction, purchasing agent, chief engineer, mechanical and electrical engineer, and accommodations for the officers having charge of transportation and installation, exhibits and concessions, are arranged to carry on the business of these departments.

On the second floor is the large draughting room, used by the force of architectural draughtsmen. This department has separate offices and draughting rooms, with a large vault for valuable drawings. On this floor are the sleeping apartments of the director of works and the chiefs of the various bureaus, comprising the department of works. Here also are numerous apartments for such of the employees as the nature of their duties requires to be continuously at the Exposition grounds. A kitchen and dining room, apartments for the janitor and hospital nurses, and several guest chambers are provided on this floor.

The top floor of the building has additional apartments, a large blue-printing room for the use of the architect's and engineer's departments, and the operating rooms for the official photographer of the Exposition.

The building has a cellar. Frame construction has been used throughout. The studs are covered on the inside with composition board and sheathed on the outside with hemlock planks, which are covered with cement plaster, the final finish having the appearance of stucco.

The ornamental work, including the flag standards, finials, festoons, etc., are of staff. The roof is covered with Spanish tile of iron. The building is in its architecture a free adaptation of the Spanish renaissance, such as is shown in old California and Mexican missions and churches. This style was followed as closely as the requirements and exigencies of arrangement for light and space necessary in a first-class working office allowed.

The building was erected ready for occupancy in thirty-two working days.

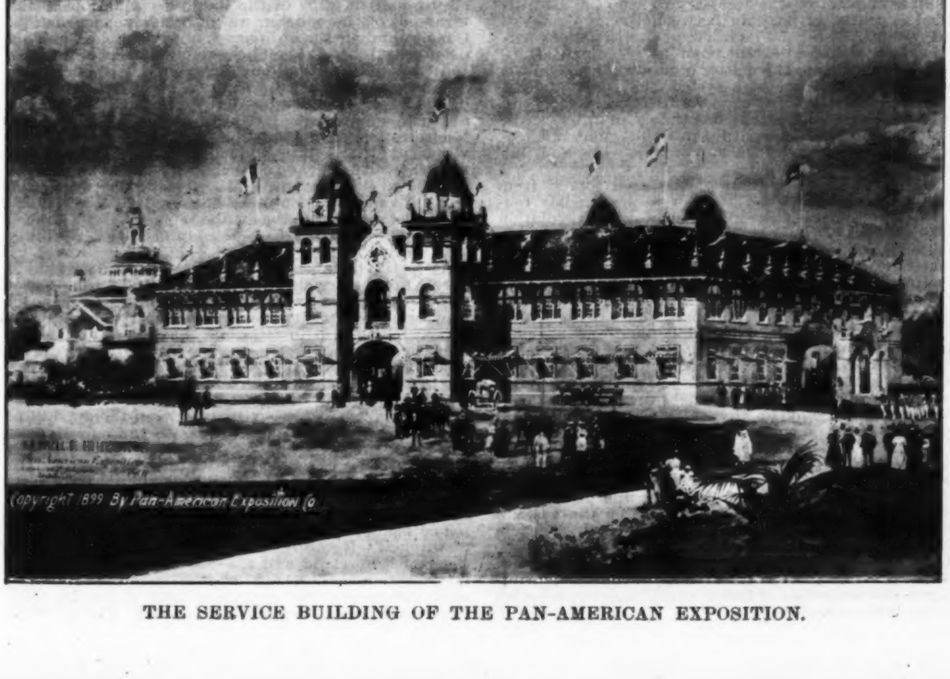
PROGRESS OF THE WORK ON THE EXPOSITION GROUNDS TO JANUARY 20, 1900.

Work was begun on the site September 28. Since that date the land has been cleared of fences, 2,400 small poplar trees, 1,200 willow bushes, and 700 assorted shrubs have been planted about the border of the grounds. A boundary fence has been built 8 feet high and 12,000 feet long. A nursery has been prepared and several thousand trees and shrubs have been placed therein. Seventy-five large trees have been transplanted from points in the site to avenues on the border of the grounds. Some 10,000 cubic yards of top soil have been scraped, piled, mixed, and turned over. Four thousand yards of excavation have been removed from the East Lake; two greenhouses, 20×80 ×10, with propagating houses adjoining, have been built, and a number of cold frames have been set out.

The grounds have been cross-sectioned; buildings, canals, and roads have been staked out; 13,000 feet of sewer have been constructed; plans for fire mains and domestic water supply have been completed; route for intramural railway has been surveyed, and from 4,000 to 5,000 feet of canal which encircles the grounds have been excavated.

Two thousand large poplar trees and maples have been received and prepared for early planting in the spring; 250 monumental cedars have been prepared, boxed, and are now awaiting spring before being shipped from New Jersey.

Plans have been completed for the foundations of the Agricultural Building, and complete plans for machinery and transportation, one of the large buildings, 350 × 500. Bids for all the main buildings will be invited at an early date, and even before spring of this year much progress in the constructive work will be made.



THE SERVICE BUILDING OF THE PAN-AMERICAN EXPOSITION.

IMPROVEMENTS IN MANSARD ROOFS AND DORMER WINDOWS.

IN large cities the upper story of houses is occupied more especially by the laboring class, and the Mansard roof, as usually planned, is ill adapted for giving any comfort to the tenant, who deserts it as often as he can in favor of the dram shop. M. A. Ferret, a philanthropist, has proposed an improvement for this part of our dwellings. For the room with the naked whitewashed walls, lighted by a dormer window, allowing but little light to pass, he has succeeded in substituting, in a few of the houses in the center of Paris, cozy rooms that receive a flood of light through a sort of small inclosed veranda. For an inexpensive window, he simply places two posts upon the window sill and connects their tops with that of the window frame by cross-pieces. The sides are fitted with stationary, glazed frames, and the front of each window is composed of glass doors, while the top is suitably roofed, as shown in Fig. 1. By this arrangement the light enters from both the front and the sides, thus giving a much greater illumination to the apartment.

FIG. 1.—ARRANGEMENT OF A MANSARD ROOF.

In the lower corner are shown the old and new types of dormer window.

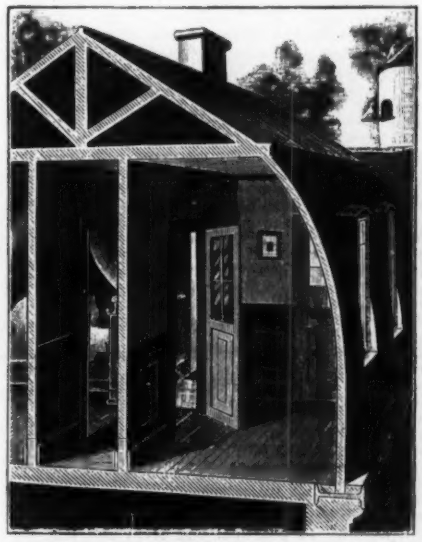


FIG. 2.—A MANSARD ROOF ARCHED TO GAIN SPACE.

Instead of the walls being whitewashed or covered with paper, they are painted in imitation of panels, so as to give a more agreeable aspect. At the base of the inclined side a vertical frame forms a wainscot, with a space behind it for the reception of various articles. A closet arranged in the wall contains a small chafing dish, and forms a sort of small kitchen that permits of greater cleanliness in the room.

If it is desired to go to a little greater expense, the size of the room may be increased by reducing the thickness of the floor, which is accomplished in the following manner:

The tiles and the plaster on which they are laid are removed, after which the joists can be cut down an inch or two in depth. About 2 inches below the top of the joists, 1½-inch furring is fastened to them, and on this boards are laid. Sand and lime filling or "deafening" covers the boards and reaches to the top of the joists, on which a wood flooring is laid. By this change, some 4 or 5 inches can be added to the height of the room.

In addition, further space may be obtained by curving the inclined walls so as to form a sort of dome (Fig. 2), an operation which will not involve much expense. If it be possible to unite two Mansards thus arranged, a small apartment is obtained, in which the family may assemble in the evening with pleasure, and which the occupants may adorn as best they know how, and render comfortable and healthful.

We have seen transformations of this kind made by way of experiment in some old houses.

The inventor, M. Ferret, is completely satisfied with the efficiency of this mode of construction from a humanitarian, hygienic, and even an economic view-point. He says that tenants for rooms which have been altered and improved in this manner are always to be found, and that the rooms will bring a higher rent, thus soon making up for the cost of the improvement. —La Nature.

PACKING INSTRUMENTS FOR TRANSPORTATION.*

THE repeated experiments of Prof. Todd, of Amherst College, in transporting delicate apparatus over great distances make valuable the method of packing he has been led to adopt. His experience is that the safest packing material is cork sawdust closely confined in cloth bags in various shapes and sizes.

This cork may be obtained from any dealer in Malaga grapes. It should be looked over to remove all foreign substances, then washed and thoroughly dried. That as little water as possible be absorbed; put not more than two or three quarts at a time into three or four times as much lukewarm water; press it under and rub between the hands till the whole has been treated; the dirt thus loosened will mostly sink, while the cleansed cork floats. Skim off carefully and squeeze or drain till dry enough to spread in the sun. If one is possessor of old-fashioned quilting frames, nothing is better; set up in a sunny room, with a large square of cotton cloth stretched over them, they furnish space

* Sabra C. Snell, in Popular Astronomy.

for spreading a bushel at once under most favorable circumstances. The drying process should be very thorough, and to insure this, it is safe to heat the cork in large flat pans in an oven after it feels perfectly dry to the touch. Any moisture remaining in the pores is thus drawn out.

The bags are made of firm cotton, closely stitched and filled nearly as hard as a pincushion. Mostly small sizes are serviceable, but for packing a large lens, two squares, each divided into several compartments, furnish good protection. Also, if it is desired to put tubes within others, long bags, a few inches only in width, filled and bent into rings, serve to separate them.

The elasticity of the cork, together with the possibility of almost perfect freedom from dust, make it for this use superior to any other substance yet tested.

IMPROVEMENTS IN THE THREE-WIRE SYSTEM.

By ALTON D. ADAMS.

THE Edison three-wire system, one of the earliest methods of constant pressure distribution, has grown steadily in application and importance with the development of electric stations. The introduction of storage batteries and of the alternating-current system have each served to widen the field of three-wire service, so that to-day there are few large stations that do not employ this method of distribution at some points. While the general principles of three-wire distribution have remained constant, the practical methods of its use and regulation have undergone fundamental improvements. Some of the changes relate only to construction, others solely to operation. During some years after the inception of the three-wire system, its underground construction in this country was carried out almost entirely with the Edison tubes. These well-known tubes are of iron, twenty and one-half feet long, and each contains three copper conductors separately wound with jute cord and all embedded in asphaltum. Joints between the conductors occur for every length of tube and are made by short flexible cables that are soldered to the copper rods where they extend beyond the iron tubes. To join the tubes, iron coupling boxes are used and filled with hot asphaltum after the copper rods are joined. The Edison tubes are laid directly in the ground, and that part of the system known as the mains is tapped at all desired points for service to consumers. The facility and cheapness with which connection may be made with an Edison main commends it at once to practical engineers and has, no doubt, been a large factor in the retention of the system. Consumers' connections to mains often occur within a few feet of each other and it is quicker and less costly to tap an Edison main than a lead-covered cable in a conduit. A three-wire distribution system for public service is usually composed of two quite distinct parts, the main to which service connections are made and the feeders which connect the generating stations with the mains at various points but are not tapped to supply customers. The feature of frequent joints and coupling boxes, so convenient in mains, is, therefore, of no particular advantage in feeders, but is, on the other hand, a decided disadvantage, for the following reasons: The loss of energy in the mains of a three-wire system is necessarily kept at a comparatively low point in order to maintain a fairly uniform pressure at the lamps. By far the greatest distribution loss is that in the feeders, and this, at times of full load, is not infrequently of sufficient amount to materially raise the temperature of the copper conductors in the tubes. If any of the many joints in Edison tube feeders are not made in the best manner they are apt to be melted at times of heavy load and an open circuit thus produced. The interruption of service and the cost of repairs by troubles at the joints of Edison tubes on important feeder lines has led to the adoption of lead-covered cables for feeders in much recent work, and this latter may be regarded as the best practice to-day. The Edison tubes are usually retained for mains, however, where their advantage is greatest.

Owing to the varying conditions of load at different points on the mains of three-wire systems, and to the unequal length of the several feeders, it is a common condition of operation that the losses of electric pressure in the feeders are not constant, or all the same, at any one time. It is, therefore, necessary that some feeders leave the generating station with higher pressures than others. It was not formerly desirable to use different generators, operated at several pressures, on the several feeders, as this made multiple connection impossible. It was, therefore, often the old practice to connect a variable resistance in the circuit of each feeder at the station and supply all feeders from a common bus bar. Pressure wires run back from the point where each feeder joins the mains, give a constant indication of the voltages at these points, and an adjustment of the variable resistances in the several feeder circuits tends to keep the pressure constant on the mains. With this method of regulation the voltage at the station bus bars must be high enough to allow for the greatest loss in any one feeder, and the excess of pressure at all of the other feeders must be taken up by their variable resistances. The energy spent in heating the variable resistances is evidently a total loss, and its amount is considerable at times of heavy load.

As storage batteries came into general use at direct-current constant-pressure stations, a more satisfactory method of compensation for the various pressure losses in different feeders was developed.

As the pressure for each cell of storage battery is only a little more than two volts, it is possible to obtain almost any voltage within the battery capacity by connections that include different numbers of cells. When a battery is relied on to meet the requirements of feeder regulation, several sets of bus bars are usually arranged to connect with the battery at the desired points. The number of batteries connected to each bus bar determines its pressure, and the several feeders are divided among the different bars according to the pressure loss in each at any particular time. While a battery is thus used to give each feeder current at just the desired pressure, the electric generators may be, and frequently are, connected to the battery so as to give the desired output and keep it partly charged.

The battery method of feeder regulation has disadvantages, among which are the large capacity of batteries required and their internal losses. The best and most widely used means for the supply of feeders at varying pressures, at the present time, is that of separate bus bars for each pair of generators, and motor dynamos, or boosters, for the transfer of energy from one set of bus bars to another. It is very important for steam economy in three-wire, as in all electric stations, that the dynamos be operated in multiple, so as to keep all of the engines in use at any one time at nearly full load. Before batteries or boosters came into use for purposes of regulation, there was no satisfactory means for the transfer of electric energy from one bus bar to another of different pressure. It was the early station practice in large plants to provide several sets of bus bars, operated at different pressures, and to connect each feeder with the bar nearest to its pressure requirements. Electric generators were connected by pairs to one or the other of the several bars, according to the load on each, and underloaded generators on one set of bus bars could, obviously, not be used at the same time for another set because of the difference in pressure. A result was that the generators were often worked at light load in order to maintain the several desired pressures. Though undesirable results as to conditions of loads were frequent in the older three-wire stations, the effects were not nearly so bad as they would be in more recent plants, did no means exist for the economical transfer of energy from one bar to another at a different pressure. The greatly increased size of generating units is a factor which makes energy transfer from bar to bar more necessary than formerly. The older three-wire stations were equipped with dynamos of from 60 to 200 kilowatts each, and from 10 to 20 machines were frequently found in a single plant. With these comparatively small generators any considerable change in load can be followed at once by a variation of the number in operation, so as to insure a large per cent. of full load on all engines in use. Central station practice has tended constantly toward larger units, however, and generators up to three, five, and even eight hundred kilowatts capacity are now in common use, while the average number of machines in a station of given capacity has greatly diminished. A very material change in the station load is obviously necessary to warrant a variation of the number of these large units in operation, and to run at a low stage of load means very poor economy of steam.

The frequent practice is to drive a pair of these large electric generators with a single compound engine, and to provide a set of bus bars for each pair. On this plan, as many station pressures are available as there are pairs of generators, and each feeder is connected to the bus bar of that generator which is furnishing the desired pressure. As the voltage necessary for the several feeders frequently changes, a given feeder may be on one bus at a certain time of day and on another bus at a different time. It frequently happens that more feeders require the pressure of one bus than its connected generators are able to supply, while on one or more other bus bars the load is much below their generator capacities; or, again, that a voltage is required which differs from that of any bus, while there is ample unused capacity in some of the operating generators.

The motor-dynamo effects a most satisfactory solution of these conditions through its ability to take electric current from any set of bus bars at the existing pressure and deliver current to any other bus bar at the voltage desired. This use of motor-generators makes it possible to supply any number of feeders with different pressures from the same generators, and thus operate with the smallest number of engines and dynamos competent to carry the station load at any particular time. Under the old system of feeder regulation by variable resistances, all of the energy taken from bus bars that was not required in feeder circuits was dissipated as useless head in the regulating coils. Motor-dynamos, on the other hand, may readily deliver at the generator end 75 to 80 per cent. of the energy absorbed at the motor end, and have the further advantage that they can be used to raise as readily as to lower the pressure. One of the distinctive features of the three-wire system is its tendency to automatic regulation of pressure for unequal loads between each outside wire and the neutral. The regulation would be perfect were it not for the fact that with unbalanced loads the drop of pressure in the two outside wires is not equal. To insure good pressure regulation at the lamps, it is necessary to keep the load divided as nearly as possible between the two sides of the system, and rely on its inherent properties of regulation to the smallest extent possible. So much attention is now given to the matter of uniform loads on the two sides of the three-wire system that only a small part of the total station capacity is concerned in the process of regulation at any one time. In other words, a very large part of the output in well-regulated three-wire stations travels on the two outside wires and but little on the neutral.

The continued extension of the area served from plants operating on the three-wire system has rendered more complex the problem of good regulation at the lamps. Increase in the radii of service from a single station has been further increased by the marked tendency to concentrate all engines and generating equipment at one point. Formerly it was not uncommon to find generating stations at several locations in a three-wire system, but the best practice has now changed to one main generating plant and as many sub-stations or distribution plants as are desirable.

Large direct feeders that have immediate connection with the general system of mains are run between the generating plant and all of the sub-stations, so that energy can be sent to any sub-station without any necessary effect on the surrounding network of mains. These large feeders direct from the generating plant to the sub-stations are supplied with current from bus bars that are usually at higher pressure than the rest of the system, so as to compensate for the greater loss of transmission to the distant parts of the system, where the sub-stations are usually located. Feeders between stations are usually run with but two cables, the third wire being omitted and the necessary regulation of pressure to keep the system in balance depending on the proper use of batteries and motor-generators at the sub-stations.

In order to avoid the large loss of transmission at times of maximum load and keep the necessary capacity at the generating station as low as possible, the batteries at sub-stations are given most of their charge during the hours when the public demand for current is comparatively small. At times of heavy load the battery at each sub-station acts with the supply then received from the generating station to carry the total load.

The motor-dynamos at the sub-stations are used either to transfer energy from one bus bar to another at a different voltage, or to transfer energy from one side of the three-wire system to the other, in order to maintain an equal load on each.

The tendency to maintain a balance between the two sides of the three-wire system by shifting feeders from one outside wire to the other, and also the use of but two wires in transmission to sub-stations from the main plant, has developed the use of generators operating at double or more than double the voltage of the ordinary generators in a three-wire plant. That is, instead of the pressure of about 125 volts common for generators on each side of the three-wire system in this country, this latter type of generator works at a pressure of from about 250 to 300 volts. The lower of these two pressures is generated when the machine is connected directly with some of the feeders that run directly to the service mains, while the higher voltage is used when the generator is supplying a heavy load to the feeders that connect the generating station with the sub-stations. Several advantages attach to the use of these double-pressure generators. Dynamos at the pressure of 125 volts must usually be connected or disconnected with the three-wire system in pairs, so as to maintain an equal capacity on each side, and each generator must, therefore, have only one-half the output by which it is desired to vary the operating equipment at one time. The 250 to 300-volt generators may, therefore, properly have double the capacity of one at 125 volts, and thereby effect a material saving in the number of points that require attention, the number of switches and connections, the important item of station floor space and the dividend-earning feature of efficiency.

The incandescent lamp is the key to the whole system of three-wire distribution. The limits to practical distribution areas, the per cent. of variation allowable in the pressure at the mains, and the cost of the system in any particular case, depend directly on lamp qualities. The voltage of lamps is, perhaps, the most important single feature, since the cost of the copper for conductors decreases and the radius of distribution increases as the square of the pressure at which lamps are operated, the load and per cent. of loss being constant.

Until within the last two years the maximum pressure of commercial incandescent lamps has remained at about 110 volts. During more than a year back, however, manufacturers have regularly offered lamps of sixteen and larger candle powers for from 220 to 230 volts pressure. The voltage of practical lamps is thus doubled at a single step, the radius of transmission increased four times, and the area of distribution multiplied by sixteen, for a constant per cent. of loss.

The great advantages to the three-wire direct system of distribution from the doubled voltage of incandescent lamps are at once evident, and are being made available in new plants.

There are many details of construction and insulation to be modified before the 220-volt lamp can come into general use on the old three-wire systems, where 110-volt lamps are now operated, but the change will no doubt be made in time, to the benefit of central stations and the public. The improvements above noted in the three-wire system, and especially the higher voltages of incandescent lamps, seem to insure for it a tendency to displace all other systems of public distribution.—American Electrician.

MR. MARCONI ON WIRELESS TELEGRAPHY.

AT the Royal Institution, February 2, Mr. Marconi delivered an address on "Wireless Telegraphy."

Mr. Marconi devoted his remarks to some of the developments, which had taken place within the last few months. He first gave a brief description of his apparatus, laying especial stress on a recent improvement, which consisted of inserting the secondary of a transformer or induction coil in the coherer circuit, the primary being connected with the vertical aerial wire. This induction coil, whose function was to increase the electro-motive force of the induced oscillations at the terminals of the coherer, was of peculiar construction. Coils wound in the ordinary way were useless or even detrimental, but the coil he employed had its primary, contrary to the usual custom, wound with fine wire and its secondary with still finer. Moreover, the wire of the latter was not wound in uniform layers, but in a special manner calculated to prevent the effects due to electro-magnetic induction from being in opposition with the electro-static induction at the ends of the primary. The efficacy of such a coil he tested during the naval maneuvers, and, working between the "Juno" and the "Europa," he found that, while the limit distance attainable without the coil was seven miles, over 60 miles could be obtained with certainty with the coil.

As to the distance of signaling, Mr. Marconi said it varied approximately with the square of the height of the vertical wire and the square root of the capacity of the form of capacity-area placed at the top of the wires. With two installations having poles 150 feet high signals were easily obtained at a distance of 85 miles, though according to a rigorous application of the law 72 miles only ought to have been obtained. It was noticeable in this case that, as the two stations were at sea level, there existed between them a hill of water over 1,000 feet high, owing to the curvature of the earth, and if the waves traveled only in straight lines, or if the effect were noticeable only across open space in a direct line, the signals would not have been received except with a vertical wire 1,000 feet high at both stations.

The lecturer proceeded to refer to the installations of wireless telegraphy that had been erected between the South Foreland and the East Goodwin Light vessel, the South Foreland and Wimereux. But the most interesting and complete tests at sea, he said, were made during the naval maneuvers. The greatest

distances at which service messages were sent then were 60 nautical miles between the "Europa" and the "Juno," and 45 miles between the "Juno" and the "Alexandra." That was not the maximum distance actually traversed, but the distance at which, under all circumstances and conditions, the system could be relied on for certain and regular transmission. During tests messages were sent to the distance of 74 nautical miles. Mr. Marconi next spoke of installations erected at Harwich and Chelmsford, 40 miles apart, which had been working regularly since September last. It was also found possible to signal between these two places and Wimereux.

After referring to the use of his system for reporting the yacht race in America and for communicating from the steamer "Paris" when she was 66 nautical miles from land, Mr. Marconi said that six of his assistants had been sent out to South Africa. The War Office intended that the wireless telegraph should only be used at the base and on the railways, but the officers on the spot, realizing that it could only be of practical use at the front, asked if the assistants were willing to go to the front, and accordingly on December 11, they moved up to De Aar. The results at first were not altogether satisfactory, owing to lack of the poles, kites, or balloons which were essential, but the difficulty was overcome by the manufacture of kites, in which they were assisted by Major Baden-Powell and Captain Kennedy, R.E. It had been reported that the difficulty was due to the iron in the hills, but as a matter of fact iron would have no more destructive effect on these Hertsian waves than any other metal, and he had been able to transmit messages across the high buildings of New York, the upper stories of which were iron. However, when kites were provided, it was easy to communicate from De Aar to Orange River—some 70 miles—and now there were stations at Modder River, Enslin, Belmont, Orange River and De Aar.

Two of his assistants volunteered to take instruments through the Boer lines to Kimberley, but the military authorities would not grant them permission, as probably too great risk was involved. It seemed to him regretable that installation were not established in Ladysmith, Mafeking, and Kimberley before the commencement of hostilities, but he found it hard to believe that the Boers had any workable instruments.

In conclusion, he said he did not like to dwell on what might be done in the immediate or distant future. But he was sure that the progress made this year would greatly surpass what had been accomplished during the last twelve months, and, speaking what he believed to be sober sense, he said that by means of wireless telegraphy telegrams would become as common and as much in daily use on the sea as they were at present on the land.

DISINFECTION AND PREVENTION IN THE SICKROOM.*

By CHARLES HARRINGTON, M.D., Boston.

UPON the discovery that he has to deal with a case of one of the diseases commonly denominated contagious, the physician directs that the patient be isolated, and that so far as is possible all infectious matter be so treated that it is robbed of its power to work injury to others. Whether the results of his foresight will be what they should be or a positive injury is largely dependent upon the care and thoroughness with which the preventive measures are instituted and carried out, for it can hardly be denied that halfway measures or the unintelligent carrying out of proper directions, with the consequent lulling into a sense of safety, may be productive of as much harm as absolute neglect of all precautions other than those dictated to one and another individual by a knowledge of possible personal danger.

The measures recommended for safeguarding the health of others in time of sickness comprise isolation, prevention of dissemination of infectious material, and disinfection, and these, I predict, will be enforced at no distant day by all intelligent communities not alone in the so-called contagious diseases, but in all diseases of a serious nature spread directly or indirectly by any of the excretory products of the body. Out of deference to the controversy over the right of the two words infectious and contagious to have separate and distinct meanings, I will here declare the sense in which I employ them. Infectious diseases include all those which depend upon the presence of micro-organism in the tissues, while the contagious class of infectious diseases includes those transmissible from man to man by direct contact or close proximity. We do not commonly reckon typhoid fever for instance, as a contagious disease, but when we read that of 206 cases of that disease investigated by Dr. Herbert Peck,† 28, or 13 6 per cent., were traced to direct infection in the sick-room, we must agree with him that the danger is more common than is generally supposed, and that it has not received the attention that it deserves. Lobar pneumonia and pulmonary tuberculosis are also not included in the contagious class, and yet we are not insensible of the fact that house epidemics of the former are not uncommon, and that the latter is largely spread by overcrowding and lack of ventilation.

It is not my intention to enter here upon any discussion of the important question of the advisability of enforcing what may be regarded as unnecessarily harsh measures for the supression of tuberculosis, nor to touch upon the extension of supervision by public authority of the handling of the sick, but rather to consider the efficiency of preventive measures already practiced.

Isolations.—The object of isolation is to remove the patient as completely as possible from all chance of acting as a menace to the health of others, whether dwelling beneath the same roof or not. In the dwellings of the poor it is usually most difficult and frequently impossible to isolate the patient in a proper manner because, primarily, of lack of space; in the homes of the well-to-do and of the rich, where plenty of room is available, it is not uncommonly the case that isolation is a mere farce because of failure on the part of the family to grasp the full importance of thoroughness, in spite of instruction by the attending physician and by the representative of the local authority. In the minds of many, isolation is complete when the patient is in a room by himself, with the door leading therefrom into the hall open or shut according to no particular rule, but according as accident has left it. To such minds the air of a sick-room is a deadly contagion to which the doorway, not the door, opposes itself as a most efficient barrier. We all have met and know the person well who says, "I was very careful not to enter the room, but talked with him from the doorway." Often the door is left open, and its place is taken by a sheet wetted occasionally by some disinfectant solution. To this thin obstacle, with more or less of open space below and at the sides, the morbific agents supposedly in the air are presumed to attach themselves as the natural processes of ventilation set the air in motion from the room outward; or, if not this, the agent with which the sheet has been wetted, perhaps hours ago, is supposed to exert a purifying influence upon every particle of passing air. Under either of these conditions, if infective matters are floating in the air of the sick-room there is no reason why they should not be carried to all parts of the house. Even shutting the door may not accomplish all that is desired in respect of preventing efflux of air from the sick-room to other parts of the house, as can be shown by a most simple experiment. Between the bottom of the door and the threshold there is usually a fair sized interval through which under the ordinarily existing, differences of temperature, and, therefore, of density, a constant stream of air is passing inward or outward. If one holds a lighted match near this space, the flame, if the air is in motion, is inclined one way or the other according as the leakage is away from or toward the room. Sometimes the current is so strong that the match is extinguished. This may seem to be a small matter, or, indeed, insignificant, but under some circumstances it may well be thought worthy of some extra care, in which case sandbags such as are used on window sashes may be found serviceable.

In those cases in which aerial infection is supposed to occur the ideal place for isolating the patient is an upper floor or an L which can be shut off entirely from the rest of the house, and ventilated thoroughly by direct communication with the outer air. Where such an area is not available, the room should be closed as completely as possible, and the immediately adjoining rooms should be kept well aired. In the class of cases in which aerial infection under ordinary careful attention to the excretory products is not to be expected such extensive precautionary measures are not necessary, and here the main points to be considered are the prevention of dissemination of infective material and the best method for the immediate destruction of the morbific agents as they are yielded by the patient.

Prevention of Dissemination.—It is quite unnecessary to dwell upon the precautions always observed by careful, experienced practitioners against the carriage of infective material by themselves from the sick-room, but it may not be out of place to mention the carelessness displayed by the thoughtless but enthusiastic beginner whom we all have seen leaning down upon the mattress and bedclothes, supporting himself by his hands, examining whatever attracts his attention, whether it be the body of the patient or the vessels containing the excretory products, and ever and anon stroking with his now possibly infected hands his hair and beard, or rubbing them against his own clothing or that of his neighbor, or hiding them in his pockets. Such carelessness on the part of the nurse in attendance would be contrary to her training, and on the part of the student or young practitioner is equally contrary to the instruction which he is supposed to have received. Absolute care in this particular is imperatively necessary on the part of all who visit or are in attendance in the sick-room.

In preparing the room for the reception of the patient, it should be borne in mind that the less furniture there is present, the less there will be to undergo the process of disinfection on the termination of the sickness. Above all the carpet should be removed at the very outset, and all upholstered furniture and draperies with it. Ordinary dusting and broom sweeping, which stir up the dust so thoroughly, should be absolutely interdicted, and cleaning and wiping with mops and cloths not wet, but well moistened with a disinfectant, should be substituted.

The used bed linen, the patient's body linen, the napkins, towels and other cloths that may become infected may be put to soak in disinfectants at once and on the spot, or may be placed within cotton bags wet with disinfectant, and conveyed at the proper time to the kettle, into which, without further handling and without opening, the whole is placed and then boiled for an hour.

The usefulness of attempting aerial disinfection in the presence of the patient is not apparently as well recognized as it should be. The placing of small amounts of chloride of lime, carbolic acid, iodine, sulpho-naphthol and other disinfectants in saucers and other open dishes, and distributing them about the room, has no other effect than the production of odors which may be an annoyance to the patient. If disinfection could be so easily accomplished, the local boards of health would be relieved of much work and very large expense. With the agents at present available for germicidal action, aerial disinfection in the presence of the patient is absolutely impossible, for they must be used in such concentration as to be quite irrespirable. But we must not overlook the disinfectant power of direct sunlight and the beneficial effects of constant dilution of the impurities of the air by proper ventilation. The latter is materially assisted by the maintenance of an open fire when climatic conditions will not permit ventilation by means of open windows, and thus practical utility and the conferring of cheerfulness are combined.

The attention on the part of the nurse to hands, hair, clothing, etc., and the frequent necessity of providing separate outfits of eating utensils for the patient, and of destroying all unused portions of his meals, need no more than passing mention.

Disinfection of the Excretory Products.—The materials which require thorough disinfection include those from the mouth, throat and nose in diphtheria and whooping-cough; from the lungs in influenza, pneumonia and pulmonary tuberculosis; from the skin in the acute exanthemata, especially during desquamation; vomitus in yellow fever and, conditionally, in other diseases; stools in cholera, dysentery, typhoid fever and tubercular conditions of the alimentary canal; and the urine in typhoid fever, and perhaps, also, in some of the exanthemata. These may be destroyed in two ways, according to circumstances. Those in not too large bulk and not too fluid, such for example, as sputum and discharges from the nose, mouth and throat received on cloths, may be most effectually disposed of by burning, if there is a fire immediately at hand. Bulky matters such as stools, urine and vomitus, and objects actually or possibly infected by them, such as bedclothing, body linen, etc., which must be purified, but not destroyed, must be brought into intimate contact with some disinfectant which fulfills the requirements of a good germicide, namely, that it shall kill all forms of bacteria and spores within reasonable limits of time, shall not be made inert by organic matters with which the bacteria are associated, and shall not subject the attendant to any dangerous consequences. If, in addition, it be cheap, free from disagreeable odor, and incapable of injuring cotton, linen and other textiles either by causing stains or by reducing their strength, so much the better. Where shall we find such an agent? Shall we find it in the shops put up in pints and quarts with attractive labels which reveal or not, according to the maker's fancy, the nature of the active ingredient? No, we are not likely to find it there; at least, that is my experience.

In March last Dr. Richard M. Pearce and myself reported at a meeting of the Boston Society of Medical Sciences the results of our examinations of such proprietary disinfectants as we could find in the apothecary shops of Boston, and it may not be out of place to report them again in condensed form at this time, for the brands obtained and examined include several that are held in high esteem by the profession generally. The list included the following: Marsh's instantaneous disinfectant, disinfectine, ozonos, bromochloralum, royal disinfectant, excelsior disinfectant, phenol sodique, Hovey's chloride of zinc, Platt's chlorides, carbolic purifying powder, and solution of chlorinated soda. These were tested with anthrax spores, typhoid cultures, typhoid stools, diphtheritic membrane, and tuberculous sputum. The mixture of material and disinfectant was intimate, and the length of time of the contact was in each case two hours. So far as demonstrating efficiency is concerned, the results were distinctly disappointing, for but one of this list was successful in more than half of the ten tests to which each was subjected, and this one failed in three. One of them failed eight times, another nine times, and three failed every time. Not one of them was successful in sterilizing the tuberculous sputum. Those which failed in all the tests were carbolic purifying powder, royal disinfectant, and phenol sodique. Those that failed eight and nine times were, respectively, Hovey's chloride of zinc and bromochloralum.

In justice to the makers of these preparations, it must be said that in no sense can any of these disinfectants be properly classed as a fraud, for chemical analysis shows that they are one and all composed of substances that are generally regarded as disinfectants and are so recommended in many of our standard works on public health. The substances found include chloride of zinc, chloride and sulphate of aluminium, alum, permanganate of potassium, salts of lead, iron, and copper, neutral tar oils, hydrochloric and nitric acids, and others. We must, therefore, believe that they are manufactured and sold in good faith. But even so, we cannot use disinfectants that kill almost every time, or that kill only occasionally; they must kill every time, and we must therefore look elsewhere.

Shall we use corrosive sublimate? Its action on many substances with which it may come in contact, the readiness with which it is thrown out of solution and made inert by matters associated with the bacteria, and its very poisonous character, make this agent unreliable for general purposes and undesirable. Shall we use caustic lime? Lime is a good disinfectant, but it has its disadvantages. It must be used in the freshly slaked state; it must be applied in very considerable amounts; it must be very intimately mixed with the material to be disinfected, for it is not very capable of self-mixing; and after it has performed its office, it must be disposed of in such a way as to cause no trouble. How to do this in a city block may be quite a problem. One's first impulse would suggest throwing it into the water-closet, but such disposal would simply create work for the plumber, for the pipes would soon be occluded. Moreover, lime cannot be used for purifying linen and other textiles. Chlorinated lime is open to all the objections that apply to lime, and the additional one of having a very disagreeable odor. Where, then, shall we turn?

In addition to the agents already mentioned, we tried a five per cent. solution of carbolic acid, sulpho-naphthol, and a somewhat similar substance which I will designate solution B, both in five per cent. strength and a two and one-half per cent. solution of formalin, one per cent. formaldehyde. Of these the first-mentioned has for years been a favorite standby, objectionable to some on account of its odor, and recommended for general purposes in two, three, and five per cent. strength. It killed the bacilli in the sputum, but was successful only once in five trials with typhoid cultures and stools and diphtheritic membrane. The sulpho-naphthol solution, which cannot be praised for its odor, was also successful with sputum, and it surpassed the carbolic solution in efficiency by scoring two successes in five other trials. The remaining two preparations were uniformly successful, though it must be said that they were tried only six times each, twice with typhoid cultures, twice with typhoid stools, and once each with sputum and membrane. Our previous investigations with formaldehyde, however, seemed to us to make further tests unnecessary, and as to the solution B, it has a most disagreeable odor and is, moreover, a patented article. I will not mention its true name because I have no doubt as to the one use to which this paper would be put, and because I have no desire to have even the appearance of writing "reading notices." I have no hesitation in mentioning formaldehyde, even though an enterprising concern interested in its sale makes it a practice to reprint, without permission, any articles which may serve its purpose. All formaldehyde is good, however,

* Read before the Boston Society for Medical Improvement, October, 23, 1899.

† British Medical Journal, September 2, 1899.

and, so far as I know, that sold by one is no better than that furnished by another.

Formaldehyde possesses all the qualifications of a good disinfectant, as mentioned before. In diluted form it has no unpleasant odor, it causes no injury to fabrics, it makes no stain, it is not as expensive as the cheapest of the proprietary preparations, and, most important, it kills every form of micro-organism with which it is placed in direct contact.

I do not wish to be understood as asserting that there are no other efficient disinfectants than formaldehyde, but it happens that I cannot speak of them from the standpoint of personal experience. Doubtless there may be others as good, but it would be difficult to conceive a superior. Ten years ago Fränkel demonstrated the superiority of the cresols over carbolic acid, and within the past two years a number of preparations containing them in their various isomeric forms and in various combinations have been placed upon the market. They have been extensively studied, and the original conclusions of Fränkel have been confirmed again and again, but the most favorable reports thus far published present no results which entitle them to admission to the class with formaldehyde. A recent publication by Seybold, who investigated and compared a number of different preparations, shows that not one of them is effective against anthrax spores, which we know are quickly destroyed by formaldehyde. It is but fair to add that solution B, which we found to be so successful with stools, membrane, and sputum, contains a considerable percentage of cresols.

Besides the cresols, various other organic substances have been extensively exploited within recent times, but each one seems to fail in some one or more particulars.

Whatever the disinfectant used in the sick-room, its application must be in no niggardly amount, for in practical disinfection extravagance is a greater virtue than too strict economy. The infected objects should be submerged in the solution so that the agent shall come into contact with the entire mass. In the case of stools, urine, and vomitus, at least an equal volume of the disinfectant should be added and the whole should be carefully mixed. Although in the case of formaldehyde the destruction of the organisms is accomplished in a much shorter time, it is best to continue the exposure for about two hours, thus erring, if at all, on the side of safety. At the end of two hours, the sterilized excretory matters may be finally disposed of by way of the water-closet, and the bed linen and similar articles sent to the washtub. There seems to be no particular and good reason for supplementing complete destruction of pathogenic organisms with any further process of disinfection, but if it suits one's ideas of necessity, the customary prolonged boiling can, at least, do no harm.—Boston Medical and Surgical Journal, December 21, 1899.

GUNS OF POSITION AND SIEGE GUNS FOR THE WAR.

We spoke some weeks ago of the need felt of heavier guns than our ordinary light field pieces. In Ladysmith, our army at first found themselves without a single gun of greater power than the regular so-called 15-pounder field gun, that is, the 3-inch piece of 7 hundredweight with a 14-pound shrapnel shell, as its only projectile. The navy, with promptness and enterprise, came to our help with two 4·7-inch quick-firing pieces, throwing 45-pounder shells, and with 12-pounder guns of greater weight and power than our field gun, both being ingeniously put into the shape required by furnishing them with impromptu platforms and carriages, as already described. We have continued to feel the want of powerful guns firing common shell. Lord Methuen's force has a battery of 5-inch howitzers, throwing a lyddite shell weighing 50 pounds. This is a field howitzer, for it weighs only 9 hundredweight, and it is mounted on a 14¼ hundredweight carriage, so that the load is by no means heavy. Efficient as these have proved, something more powerful is demanded; and last week, at two or three days' notice, were sent out 4·7-inch guns on traveling carriages. These pieces are not ordinarily thus mounted for service, and an adaptation was called for. In ordinary field operations mobility forbids anything heavier than a field gun. In a regular siege fixed platforms are used. To attack prepared positions in field operations a powerful gun on a traveling carriage is required. For the 4·7-inch gun the 40-pounder muzzle-loader carriage was found suitable, and thus an unusually powerful gun was supplied. This carriage is shown in Fig. 1. The gun fires a shell weighing 50 pounds like the 5-inch howitzer, but the piece weighing 40 hundredweight discharges it with a muzzle velocity of 1,750 foot-seconds, and great range. Like most impromptu combinations, however, it is by no means perfect, for the gun being much beyond the 40-pounder in power has also a much stronger recoil, and this may give trouble on service.

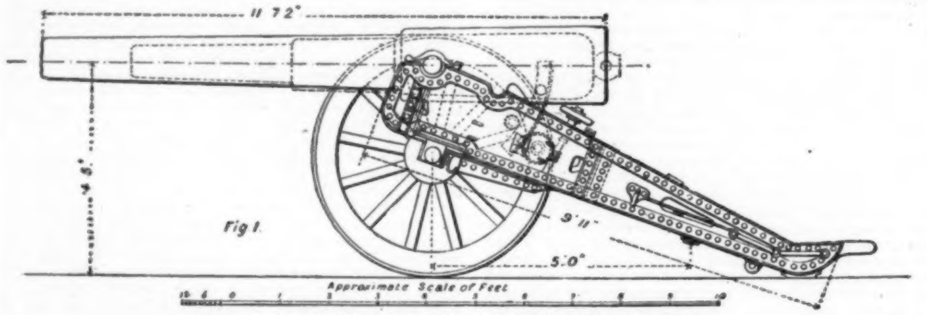
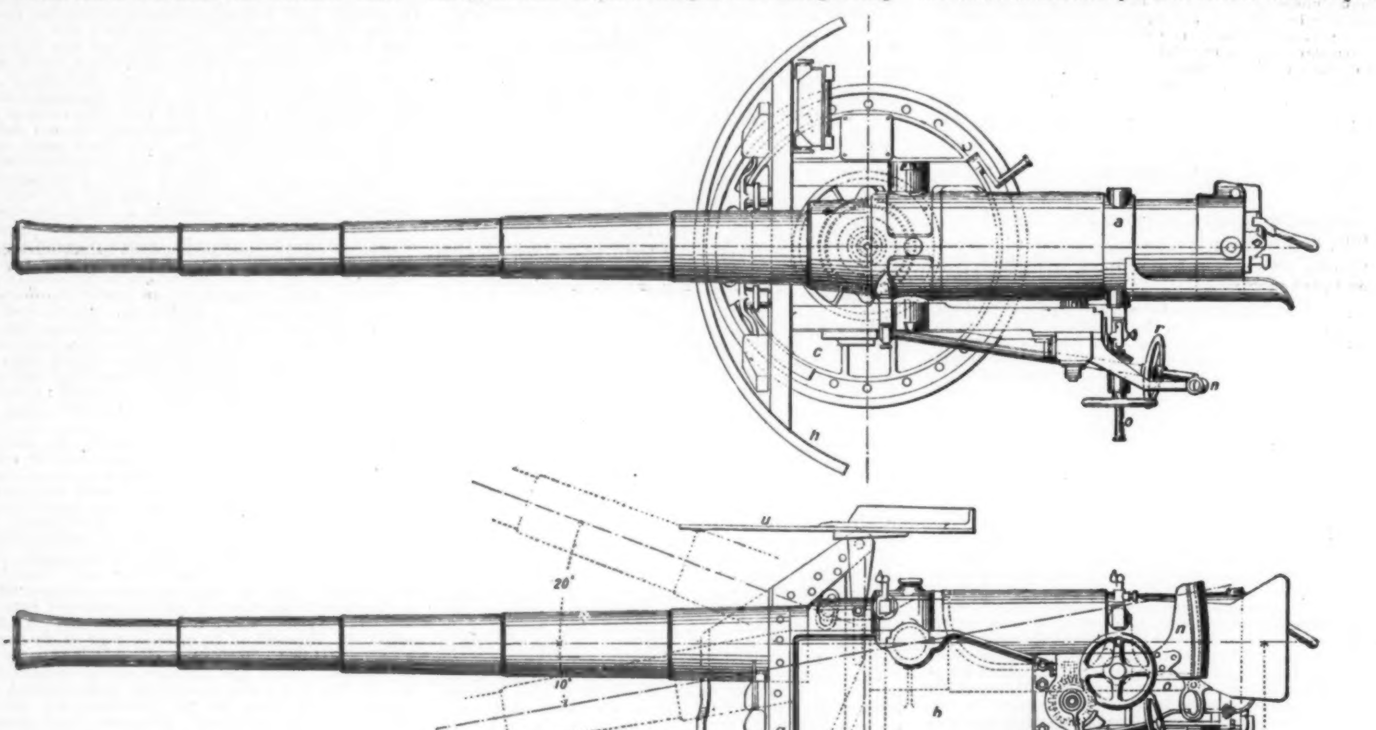


Fig. 1.—4·7-INCH GUN ON 40-POUNDER CARRIAGE.

Another and better adaptation, with the object of supplying a siege gun of peculiar power, is shown in Figs. 2, 3, and 4. The 4·7-inch quick-firing gun—that is, the piece brought up by the navy to Ladysmith—is mounted on the carriage of a 6-inch howitzer, with the recoil gear for a fixed platform removed. The result is very satisfactory for work when it is not too heavy, the total weight of the gun and carriage being about 85 hundredweight. These figures are specially interesting, we think, because they show Captain Scott's Ladysmith gun, except that his gun was fixed on an impromptu platform set with concrete. This piece has a sort of platform of planks, with an inclined wedge-shaped piece, on which the carriage moves and recoils. It is hardly probable that it will be as quick in its fire as Captain Scott's arrangement. Something will probably be lost in rate of fire in making a movable carriage take the place of a fixed mounting. It is understood that 6-inch howitzers are to follow, so that we hope that we may be provided with powerful artillery before long.

With regard to the war operations generally, we think that the lesson to be learned is what we suggested in our article of October 13 last. We spoke of "the very serious element" of smokeless powder and magazine arms having added enormously to the Boers' means of defence, and we deprecated "bold skirmishing." We spoke of the evil formerly experienced of being generally called upon to attack a position chosen by the Boers themselves, from which it was almost impossible to dislodge them, and we pointed out that the difficulties would be greater than in our previous wars, and that it was questionable if any men could do better than we did before. Writing now, we can hardly add to this, except, unhappily, to say that we have repeatedly attacked Boers in positions not only chosen, but also thoroughly prepared and fortified by them, and although two, if not three, times successful, we are now thoroughly checked. Surely we ought to recognize that this increased power in defence calls for quite different tactics, namely, extension of spade work. Instead of attacking a position, we "should endeavor to place troops opposite to our entrenched enemy in a strong defensive position, and move round" his flank. Once get behind him and trench, his supplies are cut off, and then he has to make the attack instead of us, or be starved into surrender. Doubtless, in many



Figs. 2 and 3.—4·7-INCH QUICK-FIRE GUN.

cases, this is not practicable, but once grasp how easy the defence of a trench is, and surely we could in many cases either succeed or so far threaten to succeed as to cause the enemy to fall back. The spade, we believe, is the weapon called for by the magazine rifle and smokeless powder, and the sooner we apply it the better. To apply it, we must grasp the fact that we can push smaller forces than formerly forward, and surround bodies of men that we could never have attempted to surround had we not the power of forming

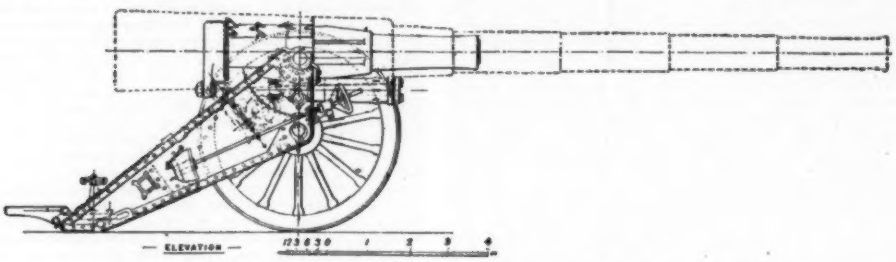


FIG. 4.—4·7-INCH QUICK-FIRE GUN ON 6-INCH HOWITZER CARRIAGE.

a terrible belt of fire without smake. It appears to us that the General who best grasps this practical use of trenching will win. Perhaps attacks may become more and more rare; the question will be who so checkmates the other as to drive him to the alternative of attack or surrender. It is conceivable that an army might surround one of equal size and starve it into surrender. Thus we can conceive two armies opposite extending their trenches like arms, and trying to enclose each other, and when one is outflanked, as seems to threaten Lord Methuen, we question if he ought not to prepare a wider curve of trench behind and fall back on it. The hope of advancing on his present line so as to relieve Kimberley seems very poor. For the moment it may be questioned if he could do better than draw gradually and safely back, so as to keep the very large force now opposite to him digging trenches and following him, instead of being more mischievously employed elsewhere. All our speculations at home, however, must be made with reserve, as we cannot know the local conditions as those on the spot know them.—The Engineer.

THE SCHNEIDER-CANET GUNS.

THE Schneider-Canet guns which the Boers are employing with so much success in the war that they are waging with England merit a description by reason of the perfection to which they have been brought. We shall confine ourselves here to giving a few data as to the 6-inch gun, which is designed for the armament of earthworks and coast fortifications, and which is capable also, with a few modifications, of being employed on board of ships.

The Russian and Japanese governments have definitely adopted this gun, but in selecting a slightly smaller caliber, and Spain has followed their example.

The Schneider-Canet 6-inch gun consists essentially of a pedestal to which is fixed a bolster upon which rests the gun frame and cradle (Fig. 1).

The gun is set into the cradle, and is connected therewith through an elastic device to be described further along.

The diagram in Fig. 2 shows the manner in which these different parts are arranged. The bolster is provided at the top with a strong pivot around which the frame revolves. The latter rests upon a ball race that permits it to revolve with great ease.

The frame is provided at the top with bearings for the reception of the trunnions of the cradle. Internally it is furnished with a bush for the pivot of the bolster. A toothed pinion that gears with a spur-wheel permits of producing the rotary motion. The frame is prolonged behind by a platform designed for the use of the gunners, who are protected from the missiles of the enemy by a shield.

The cradle consists of two longitudinal members connected at their extremities by collars, and between which the gun is capable of sliding without taking on a rotary motion.

The cradle is capable of revolving around the axis of its trunnions through the intermedium of a toothed sector and a pinion, the former fixed to the sleeve and the latter to the frame.

The gun is provided with a collar to which the movable part of the elastic device is fixed, while the stationary part of the latter is attached to the cradle. The gun consists of a tube and a jacket. The breech fermeture is that always used by the Schneider-Canet establishment. It is opened through an interrupted screw in a single movement. The screw is provided with an extractor and a hammer. The elastic device consists of a brake and a recuperator. The former is hydraulic, and the latter is composed of Belleville springs.

When the gun is fired its recoil acts both upon the brake and the recuperator, which tend to diminish it. At the end of the recoil, the recuperator brings the piece back to its initial position.

The line of sight is established upon the cradle, as in all rapid-fire guns. The direct and upward pointing are effected with the greatest ease through the use of ball-bearings for the first and a perfect equilibrium of the gun for the second.

The piece is served by seven gunners, three of whom do the loading and pointing from the platform, while the four others pass the ammunition. This 6-inch gun may be constructed with various lengths of chamber, say, 40, 45, or 50 calibers, according to the initial velocity that it is desired to obtain.

The following table gives the principal data concerning three guns corresponding to these various lengths of chamber:

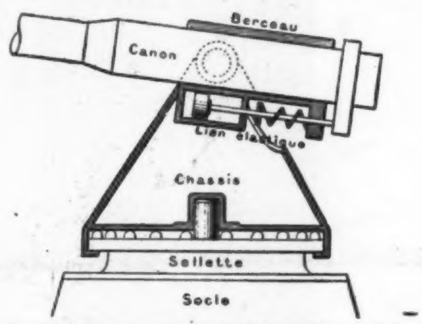


FIG. 2.—DIAGRAM OF THE MOUNTING OF A 6-INCH GUN.

	40 Calibers.	45 Calibers.	50 Calibers.
Weight of gun (pounds)	10,560	12,760	13,596
Total length (feet)	20	21·6	25
Height of trunnions (feet)	8·5	8·5	8·5
Weight of frame, platform, and loading apparatus (pounds)	17,160	17,160	22,965
Weight of shield (pounds)	2,420	2,420	3,740
Arc of upward fire	+15°—10°	+15°—10°	+50° 10°
Weight of projectile (pounds)	99	99	99
Initial velocity (feet)	2,490	2,570	2,705

The rapidity of fire of these guns is eight shots per minute. For the above particulars and the engravings we are indebted to La Nature.

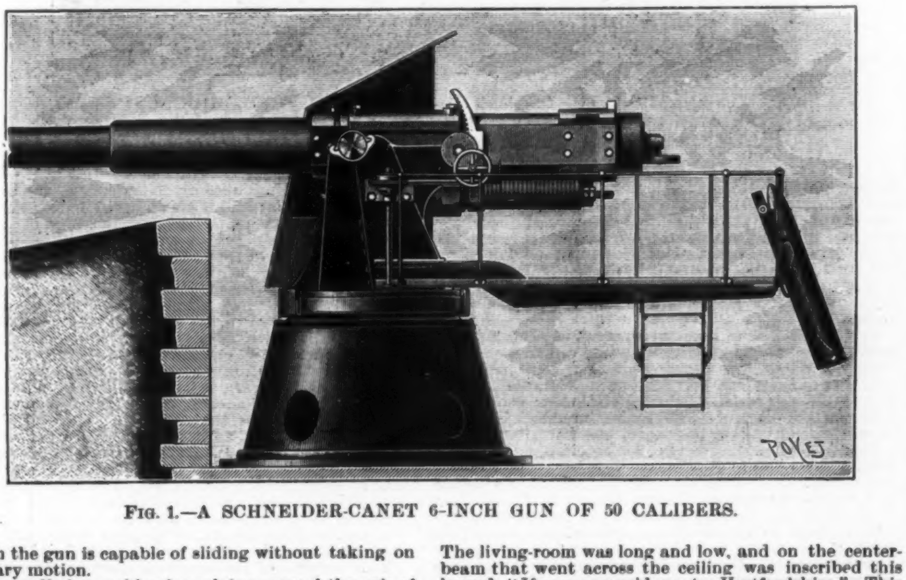


FIG. 1.—A SCHNEIDER-CANET 6-INCH GUN OF 50 CALIBERS.

Just upon the boundaries of Bedfordshire and Hertfordshire formerly stood a rambling old farmhouse. The living-room was long and low, and on the center-beam that went across the ceiling was inscribed this legend, "If you are cold, go to Hertfordshire." This seemingly inhospitable invitation was explained by the fact that one-half of the room was in one county and one-half in the other. The fireplace was in Hertfordshire.

ACETYLENE AND THE MANUFACTURE OF MINERAL BLACKS.*

By M. GEORGES F. JAUBERT.

BEFORE taking up the manufacture of smoke black by means of acetylene, a pigment better known under the name of acetylene black, I will say a few words on the preparation of smoke black in general.

Soot or smoke black is not devoid of interest. Germany alone exports every year more than one million of kilos, representing, at the average price of one franc per kilo, the sum one million francs. In 1894, the figure, as given in the reports, was six hundred and seventy-eight thousand marks; since then the production of smoke black has increased.†

Thus, in the Black Forest, where an inferior quality is produced, there are five factories in active operation, with a weekly production of from three hundred thousand to four hundred and fifty thousand kilos.

The black is used for different purposes, according to the degree of fineness; for example, in the manufacture of printing inks, blackings, black varnishes, fine colors, India ink, etc.

There are also distinguished, according to the purity, fineness and shade of blackness, and by the method of manufacturing, numerous kinds of black, of which the price varies within considerable limits. Until the present time, smoke black has been the product of incomplete combustion of carbon, by which it is separated from the flame in a pure and quite finely divided state. Thus, according to its origin, it is designated as smoke-black, tar black or lampblack, the last named proceeding generally from the combustion of gases.

For the manufacture of smoke black and tar black, high chimneys are used, having chambers in front, on the walls of which the black is separated, being removed by iron scrapers.

Formerly, in the Black Forest, only the resin of the firs was employed as the principal material; to-day the residuum resulting from the distillation of this resin is utilized; as also cold tar, and the heavy oils of tar. One hundred parts of tar yield twenty-five parts of black, while the residuum of resin yields only twenty per cent.

A proper cooling is the essential condition of the production of the black, in order to avoid its being set on fire; for it is known that smoke black, while yet warm, will burst into flame spontaneously.

All these processes yield only a black of inferior quality; and it is always mixed with tarry substances. Black of this kind does not unite with water, in consequence of the presence of greasy substances which prevent the water wetting it thoroughly, and if mixed with white it becomes a brownish gray, bordering on red, which does not allow its employment for good printing.

A product really valuable is lampblack, which is generally obtained by causing cold surfaces to be brushed by strong flames of oil or gas. These flames are produced either by oil lamps of ordinary construction or by the combustion, with suitable burners, preferably Argand burners, of the oil or gas made in special factories. Experiments have demonstrated that a free admission of air is advantageous for this combustion, as it improves the quality of the black, although the yield is less, in consequence of the more complete combustion. This lampplack is a product of exceptional purity. Dilute sulphuric acid, alcohol, or an alcoholic solution of potash can take nothing from it. Benzine extracts in very small quantities a solid yellow substance. The following is the result of a combustion.

	Containing ash.	Free from ash.	Extracted by benzine free from ash.
Carbon	96·446	97·390	99·095
Hydrogen	1·051	1·061	0·905
Ash	0·970	....	....
Oxygen	1·553	1·549	....

In the process of smoking, the suitable cooling of the receiver is always an essential condition. Different systems of apparatus are employed for the process.

The Dreyer apparatus is composed of a polished iron drum, having thin walls, and mounted on cushions with the aid of two hollow axles, so as to turn, while being constantly cooled in the interior by means of cold water, which enters and passes out through the axles.

Around the cylinder, separated by some centimeters, is a sheet iron mantle, and the row of burners is placed below the cylinder. By a slow rotary movement the black is deposited on the smooth cylinder and is constantly removed by a brush arranged for the purpose.

In the Thalwitzer apparatus, which is preferred in certain cases to that of Dreyer, the black is deposited on a horizontal rotary metallic disk, having a border projecting considerably, and is also cooled by a current of water. The flames are underneath, and the black is continually removed by a metallic scraper and falls into a receiving hopper.

While, in these processes, the black is obtained, as I have already said, by a partial combustion of the carbon, experiments have been going on for a long time to avoid this waste of material, and to obtain the pure carbon directly from the separation of the hydrogen carbides by means of pyrogenetic processes or by electrolysis.

M. MacTighe has proposed a process of this kind, he causes the vapors of the hydrocarbons to pass through retorts excessively heated, and thus obtains a decomposition, with complete separation of the carbon, in the form of lampblack. The process of Schneller & Wisse may also be referred to as of interest. It uses for the same purpose electric currents of high tension, varying from ten thousand to forty thousand volts. The two electrodes are introduced in the hydrocarbons to be treated, the current is broken, and the carbon is immediately disengaged, extinguishing the arc and serving as a conductor. Similar trials have been made several times, but they do not seem to have led to practical results.

On account of the inequality in the value and the great difference in price of different qualities of black, it can be readily understood that from the beginning methods have been sought that would purify and improve the

* Translated from La Revue des Produits Chimiques.

† Anton Ludwig: Zeitschrift fur Calciumcarbidfabrikation und Acetylenbeleuchtung, May 20, 1899.

black. So it has been proposed to fill hermetically closed boxes with the crude black and heat them to the red. Still as with this process the end proposed, that is to say, the removal of tarry substances, is only realized after a repetition of five times or more, it can only be employed for superior qualities. This is also true of experiments designed to purify by prolonged boiling with a lixivium of soda, and subsequent washing and drying.

In general, the black obtained by combustion is not now submitted to any ulterior treatment; it is merely assorted, according to the degree of purity and fineness.

It is only a short time since, in the fabrication of the black, those gaseous hydrocarbons only were used which had a double combination (as benzine for example); while those of single connection do not disengage carbon at the time of heating, and those hydrocarbons with a triple combination cannot be obtained cheaply. The discovery of calcium carbide and the means of readily obtaining acetylene in large quantities has allowed the utilization of the property which this hydrocarbon possesses of producing smoke black. It has been found that the black obtained by means of acetylene is of a very desirable shade and of exceptional fineness, even too fine for certain purposes. The acetylene black is sufficiently miscible with water, oil, a solution of gelatine, and with varnishes in general. The colors fabricated with it are of striking brilliancy and an intense black, even in fine lines. The analysis of a sample shows, besides the entire absence of substances soluble in benzine, alcohol, or an alcoholic solution of potash, a proportion of about 99·2 per cent of carbon.

As to the theoretical yield of 92·3 per cent of black, if it were obtained in practice, it would be four times greater than that of the best oil gas, and would cause the manufacture of acetylene black to be among the most remunerative, on account of the quality of the product, especially as the process would be comparatively simple.

Of course the experiments made for ascertaining a process suitable for the manufacture on a large scale, were first directed to the methods and apparatus long employed for the production of lampblack or smoke black. The systems of Thalwitzer and of Dreyer were experimented with. Although the black of acetylene is deposited on the cylinder cold, like the black of other gases and hydrocarbons, it is not less true that there are inconveniences in the way of the application of these processes. In consequence of its lightness, its dryness and its flocculent nature, instead of falling into the hopper, it is diffused all about. Besides, the choice of a suitable burner is a difficult problem. The ordinary round burners, which behave well with the gas of oil, were, in a short time, completely obstructed by carbonaceous deposits; they became incandescent and burned out. The burners with a slit were also soon obstructed.

The burners usually employed for the combustion of acetylene do not yield a sufficient quantity of black. Experiments have been made with the Bunsen burner, but its uselessness was soon apparent, for the high temperature produced under a slow rotation of the receivers caused a strong heating, and even a flaming of the black deposited. On the other hand, in a more rapid movement, the particles of black were detached and flew away under the action of the current of air and the centrifugal force. At length these difficulties were overcome, and the process of flaming was utilized for acetylene with certain modifications.

In the system of chambers the obstruction of burners and the great heat of the flames of acetylene cause certain inconveniences. Besides, the quality of the product is not so good as with the first process, because the flames ought to burn laterally or obliquely; there results an overheating of the pipes and a partial decomposition of the gas before it is set on fire.*

The most important processes for acetylene are those, which, like the processes of Tighe and of Schneller & Wisse, depend upon the decomposition of the gas without oxidation. It has been known since 1862, from the valuable work of M. Berthelot, that acetylene free from air is decomposed at 770° into its elements. Messrs. Berthelot and Vieille have since found that this decomposition, at a pressure exceeding two atmospheres, spreads throughout the whole mass as soon as it has commenced at any point. This separation, which is produced with increase of pressure, may be effected either by a heating of a point of the wall of the receiver to the required temperature or by means of a platinum wire heated to the red by an electric current, or by an electric discharge between two electrodes, or by the explosion of a percussion cap in a receiver of compressed acetylene.†

Experiments for obtaining acetylene black at low pressures have been undertaken by Messrs. Berger & Wirth, of Leipsig, which have demonstrated that this gas may be decomposed under these conditions by the spark of an induction coil.

The question of the form suitable to be given to the apparatus has presented difficulties, for continuous action is not possible except when the smoke black formed by each spark is immediately removed by a new quantity of gas.

Black is also obtained by passing acetylene through incandescent tubes (Berthelot). Still, a practical application of this process seems out of the question, on account of the formation of graphite, which soon obstructs the pipes.

With compressed acetylene, and the way opened in 1896, by Messrs Berthelot and Vieille, experiments appeared at first sight to present more chances of success, because a single explosion is sufficient to decompose immediately the whole mass of gas. Communications on these experiments have been published by M. Hubou.‡

Continuing the experiments made by Messrs. Berthelot and Vieille in 1896, M. Hubou estimates that in the decomposition of acetylene compressed at two or three atmospheres, there is not produced, under the action of an incandescent wire, pressures greater than twenty-five atmospheres, pressures which can be rendered inoffensive by a judicious selection of the receiver. Under these conditions the separation of the hydrogen and the carbon takes place rapidly. For receivers M. Hubou proposes steel cylinders. Vessels of this kind would, however, present the inconvenience of difficult closing and emptying, and it seems preferable to use large boilers or capacious chambers of sufficient strength, to which access could be had through a man-hole, as several persons have proposed. As to the pressure that exists at the time of decomposition, the position of Hubou nearly concurs with the conclusions which Gerdes has drawn in varifying the work of Berthelot and Vieille, according to which the tension ought to increase in the proportion of seven times one-half the initial pressure. Consequently, if acetylene at three atmospheres is employed about twenty-five atmospheres will have to be calculated for, and the receivers ought to be gaged for between forty and fifty atmospheres. Among the means for determining the explosion, it seems suitable to suppress, on account of the diminution of the resistance of the receivers produced by heating, that which consists in bringing the receiver to the temperature of the decomposition of acetylene, and which was employed exclusively in the experiments of Pintsch; on the contrary, nothing seems to be opposed to the utilization of the electric current and explosions. Still, it is evident that in the construction of apparatus practically useful great technical difficulties will be met with, and the question arises whether the expense of such a plant will be proportioned to the benefits to be derived. Besides, the mechanism ought to be of considerable size, on account of the lightness of acetylene black and the vast space it occupies.

On the other hand the employment of acetylene allows the separation of various kinds of black. Thus, Berger & Wirth have obtained, by the combustion of mixtures of acetylene and oil gas in variable proportions, different sorts, which vary in their properties, from the best black of oil gas to the pure black of acetylene.

Finally, some experiments can be cited which have been undertaken to obtain acetylene black by a chemical action. It is thus that M. Ludwig, in pursuance of a communication of Messrs Moissan & Moureu, has subjected finely divided metals to the action of acetylene, such as spongy platinum, reduced iron, etc. With heat, a separation into hydrogen and carbonaceous deposits occurs. He has also experimented with the known action of chlorine on acetylene. Nevertheless, both from an economic and industrial view-point, the results, in these cases, have not been encouraging.

* Compare the article of M. Ballier on the Action of the Temperature on the Decomposition of Acetylene. Revue generale de chimie pure et appliquée. I. p. 275.

† The electric arc itself also promotes this reaction, but it soon stops, and a contrary reaction taking place, a state of equilibrium is obtained. As is known, it is by means of this contrary reaction produced by the jetting arc in hydrogen that M. Berthelot was able to realise his synthesis of acetylene.

‡ M. Hubou has patented the application of the decomposirion of acetylene to the fabrication of smoke-black, the very curious apparatus by which effects this application, is to be seen at the International Exposition of Automobiles.

The Wallace collection of art treasures will probably be opened to the public by the beginning of May.

THE METHOD OF TESTING ROAD METALS.

MR. HARRY FIELDING REID has an excellent chapter on "Qualities of Good Road Metals and the Methods of Testing Them" in the report on the highways of Maryland, which has just been issued by the Maryland Geological Survey, under the direction of Prof. William C. Bullock, and through the latter, we are enabled to present an illustration of a section of the testing laboratory and give some account of the work which is carried on. In order to resist the various agents of destruction the stone of the road surface must be so hard and tough that it will not be readily broken and ground into small particles. The separate stones must be so firmly held together that they cannot be easily knocked out of place and they must become so consolidated that all water will run off the surface of the road and the foundation be kept perfectly dry.

Moreover, the greater the specific gravity of the rock and of its constituent minerals, the less readily will the smaller particles into which more or less of the surface rock is always broken by travel, be blown or washed away. It sometimes happens that so much of this finer material is carried off that the road's surface becomes a mass of loose stones. The large amounts of money spent on the maintenance of roads make it a matter of very great importance to select a material that will wear well; a great saving can be effected if we can know before building our road what is the best material to use. Undoubtedly, experience is the best test of road materials; and if we could build a mile or two of roads of various materials, and in different parts of a State and open them for travel for a period of years, and if at the end of that time we could make a careful examination of the wearing down of the road surface and other disruptions of the road bed, this would undoubtedly be the best means of determining the relative merits of the various materials. But as the number of available materials is very large and the wear on the road is very uneven, it would be necessary to make a very large number of measurements at different parts of the various roads in order to determine the average wear for each, and also to keep a careful record of the repairs that had been made in order to allow for them, and as it would require between five and ten years' time to get results of any value, this method is evidently not at all a practical one for Maryland at least at the present time. One must, therefore, turn to laboratory methods to determine the wearing qualities of a road-metal and its resistance to the weather, and the results are of great value even where they are not as accurate as might be desired.

TESTING LABORATORY OF THE MARYLAND GEOLOGICAL SURVEY, SHOWING ABRASION MACHINE AND REVOLVING SIEVE FOR DETERMINING THE VALUE OF ROAD MATERIALS.

Thin sections of rocks are made and they are examined with the microscope to show the structure of the rock. This method does not give the relative wearing power of the rock and cannot be regarded as a satisfactory test, but it is valuable in making clear the causes of the difference in strength and, therefore, in suggesting among what classes of rocks good road-making

material will probably be found. A Deval abrasion machine is in use in the laboratory of the Maryland Geological Survey, and it is shown in our engraving. It consists essentially of an iron cylinder 8 inches in diameter and 13½ inches long, mounted diagonally on a rotating axle. The stone to be tested is broken and will just pass through a 2½-inch ring, and 11 pounds of this broken stone are placed in the cylinder which is then firmly closed and rotated at the rate of thirty turns a minute for five hours making in all 10,000 revolutions. A counter shows when the proper number of revolutions have been made. At each turn the stone rolls off from one end of the cylinder to the other, and the edges are gradually broken off and the small particles thus formed are ground to fine dust. Before being placed in the cylinder the stone is carefully cleaned and weighed. After the experiment it is again cleaned and weighed together with all particles larger than $\frac{1}{16}$ of an inch. The difference between these weighings gives the amount of dust formed and is the test of the wearing quality of the stone. The machine shown in our engraving has two cylinders so that two tests can be conducted at the same time. The time necessary to weigh the rock before and after the test and the time of the test itself rarely allows more than two rocks to be treated daily. This machine gives results which will enable the engineer to get a very accurate idea of the relative value of the road metals.

The resistance of the crushing action of blows can be measured by determining the force of the blow necessary to fracture a piece of rock of a given size, therefore, the determination of the cementing power of the dust formed by the grinding of the rock is a test of great value. The dust produced in the Deval machine is passed through a rotating screen having a hundred meshes, to the inch and all the dust that will go through is collected and formed into a briquette. This is then compressed by a machine under pressure of 1,100 pounds. These briquettes are laid aside for two weeks to dry and are then subjected to the test of determining the cementing power. This consists of striking the briquette a number of light blows with a hammer weighing 2·2 pounds. The number of blows necessary to break the briquette is the measure of cementation value. This is done with the aid of a special machine which delivers the blows accurately, and which also registers the number of them.

MANUFACTURE OF TILES IN PERSIA.

THE manufacture of porcelain, glazed, and encaustic tiles dates from a very remote period in the history of Persia. Tiles have been excavated in their almost original luster from the buried cities and entombed palaces of Babylonia, Persia, and Media, and are now among the treasures of the museums of the West. The United States Vice-Consul at Teheran says that tiles in their pictorial aspect have considerable variety of form and representation. In one instance a tile contains a complete picture, while in another it may form a small section of a large composition. In the earlier stages of the art, the surface of the tiles appears to have been generally smooth and flat, while in later developments raised or embossed figures have entered largely into the design, especially for mural and frieze ornamentation. The æsthetic idea was generally modified to represent the character, the predilections, and the policy of the reigning monarch of the period. Warriors in complete armor, hunting, feasting, and at religious devotions diversified the illustrative scenes. In the superiority of materials, in the delicacy of design, in the beauty of coloring and perfection of finish, nothing has perhaps equaled the work of the 13th, 14th and 15th centuries of the Christian era. The tiles produced during this period were generally devoted to the decoration of mosques, holy places, shrines, and tombs of saints of the Mohammedan faith. The center is composed of flowers or geometrical figures, and the border consists of written passages from the Koran. A golden tint pervades the whole surface, sometimes united with a shade of blue, giving to the design a peculiar softness and charm. The materials and the method of producing this characteristic are now unknown, and hitherto no attempt to reproduce it has been successful, either in Persia or Europe. One tile manufacturer in Teheran, after experimenting for many years, according to the vice-consul, seems to be on the path to success. How their beautiful art was lost to the world is often asked, but without eliciting any satisfactory answer. It should be noted that vessels of household use, especially vases, ewers, basins, and dishes, were made of the same materials with the same glow and tint of coloring, but being more delicate in texture and more fragile in form, very few examples remain. At the present time, two classes of tiles are made—the plain and the pictorial; the former in a variety of shades for flooring, and the latter chiefly for mural decorations. As a general rule, tiled floors consist of alternate white and colored rows, though some are laid in composite designs. The masonry of the gates of Teheran, the domes of mosques and shrines, and some public buildings are overlaid with variegated tiles in arabesque or mosaic designs. The effect is graceful though decidedly Oriental. The thickness of the tile varies from two-thirds of an inch to three inches. Those used on the outside of buildings are the thickest. The material used in the composition of the ground work consists of nine-tenths of pulverized quartz to one-tenth of strongly adhesive clay, and the glazing is compounded of flint and potash. All the minerals used in the manufacture of tiles and porcelain for ground-work, glazing, and coloring are found in the country. With our preconceived notions of complicated manufacturing process, it is difficult to imagine that the most beautiful carpets in the world are the product of the gipsy's tent, or that the glowing surface of the ornamental tile can have received its shape, color, and hardening in a mud hut, with no more machinery than a pestle and mortar and an ordinary knife. No sanitary laws exist for the regulation of the workshops, or even a general inspection of the conditions of living and habitation. In this respect every man is a law to himself. The tile will continue to be used as a covering and ornament for the domes, cupolas, and minarets, both inside and outside of mosques and other sacred buildings; but for houses and public buildings it seems to be gradually falling out of the taste and fashion of the times, and giving way to simpler and cheaper materials. For durability it is superior to anything now in use, but the cement by which it is attached to the masonry lacks the proper adhesive qualities, and it often separates and falls away. The tile business of Persia is very humble and simple. The most extensive is carried on from pulverizing the quartz to putting the finished article on the market by the proprietor, his son and four assistants. It is difficult to give an estimate of the prices of tiles, for the variety of shape, ornament, and size seems to almost equal the number of tiles produced, and each has a different price. Hitherto the foreign demand for this product has been comparatively small. Orders have been executed for London and Paris. The heavy cost of transport is the chief hindrance to the export trade. So long as the camel, the mule, and the ass are the only means of transport, Persian industries will labor under great disadvantages. The rates for carriage are for tiles the same as for every species of merchandise—viz., from 4d. to 6d. a ton per mile, which means from Teheran to Bushire, exclusive of customs and commission, about £16. Vice-Consul Tyler says in conclusion: "The Persian government gives no encouragement and lends no aid to native industries, beyond being a purchaser of the goods produced. A little help in reviving old arts and supporting modern ones would benefit a large section of the population, and give an impetus to the exercise of artistic and mechanical skill."

THE EMDEN RATHAUS MODEL OF AN OLD WARSHIP.

IN the Rathaus of Emden, says Die Illustrirte Welt is the model of an old warship which is to be sent to the Paris Exposition and which has a length of 8·1 feet from stem to stern and of 6·23 feet along the keel. The model has three masts and a bowsprit with a bowsprit mast. On the battery deck are 22 cannons and two stern-chasers. On the upper deck are 20 cannons, on the quarter deck 10, and on the forcastle deck 6, making 60 in all. The stern bears the escutcheon of the city of Emden, surmounted by a crown. Amidships at both sides are two large lanterns. Above the cut water is a group composed of three figures, two men in the act of aiming a gun and protecting a woman.

MODEL OF A SEVENTEENTH CENTURY THIRTY-GUN SHIP.

Warships of this kind were built between the end of the seventeenth century and the last quarter of the eighteenth. A 60-gun vessel of the type in question had a displacement of 2,000 tons and a crew of 200. Its length was about 150 feet, beam 40 feet, and draft 18 feet.

TRIP FROM TEHERAN TO SUSA.

By JACQUES DE MORGAN.

THE trip from Teheran to Susa, was accomplished very rapidly and under the most adverse conditions to research and archæological observations. Compelled as I was, by circumstances, to abandon the usual road from Korremabad, I had to cross the Pouch-e-Kouh Mountains and to travel through a country unfortunately unexplored, where ruins of all ages are very abundant. From Teheran, which I left on November 3, 1897, until Derrè-i-Chahr, on the Sein-Mèrrè, where I arrived on the 29th of the same month, I went through known countries, or at least regions which I had crossed in 1892, the description of which I have already published. From Derrè-i-Chahr, I marched to the southwest, crossing the great wall of the Kebir-Kouh Mountains, then descending in the valleys, connected by their natural declivities either with Mesopotamia or Sisiana. I had visited those valleys in 1892, at that time the Vali of Pouch-e-Kouh was at war with the Beni-Lams Arabs. Between the Kebir Kouh and the Dinar-Kouh mountainous range, located on the southwest of the main spine, we met with some unimportant ruins of the Sassanian period. It is beyond the south of the Dinar-Kouh, that are located the valleys which were more settled in ancient times.

At a locality called Kelatch are standing the ruins of a Sassanian city, which was quite important. The citadel stood on an abrupt rock overlooking the plain by at least 40 meters. At the foot of this rock were scattered the remains of buildings similar to those of Derrè-i-Chahr, that is to say made of pebbles cemented with plaster. In this locality is running a small stream of sulphurous and saline water. It would be difficult to conceive how such a small rill could have supplied such a populous city, if the remains of numerous works of canalization did not give evidence that sweet water was brought here from far away in the mountains.

Kelatch is located some 150 kilometers from the Kerkha, to the north of this river, the nearest point being between Pa-i-Poul and Eican-i-Kerkha. Between Kelatch and the Susiana a broad valley is spreading, barren to-day, but formerly flourishing. Here are often to be seen remains of ancient canals, which used to bring to the cities and to the country at large water from the rivers flowing toward Mesopotamia. They form to-day the River Tib, an effluent of the Euphrates. This valley appears with an average width of about 20 kilometers, and is formed by two ranges of mountains, on one side the Dinae-Kouh, on the other the chain which running near Bayat, extends to the southeast as far as Ram-Hormuz, where it forms in the Karoun, the rapids of Ahwaz. The natural stratigraphic formation of the soil, would have naturally brought the drainage of this watershed toward the Kerkha, if on the right side of this river, hills had not been formed, unimportant in height but yet sufficient to prevent the flowing of water, which, unable to break the southeastern obstruction, cut through the Bayat gate and now runs toward Mesopotamia. We have seen that the Persians of the Sassanian period, have inhabited this district, but the remains of their presence are far less abundant than those left by the greater antiquity. In the Mesopotamian plain, on the Turkish territory, there is a huge tell (mound) "Seba-at-Kherib" in Arabic, "Teherar" in Persia. On this spot, supported by the general study of the country, and the annals of Assyrian wars, I have on my map of Elam, located the site of the city of Gamboulou, name which possibly may have belonged to the whole district of which I have spoken before.

At Bayat stands also a large tell, containing the remains of the fortified city that guarded the pass. Then in the valley itself we meet with Tepeh-Chakal-erpi (the mound of the white jackal), Tepeh-Miziaw, Tepeh-Ramch-borde (the mound of the stolen herd), Tepeh-Patak, and a number of more or less important mounds, being evidence of the great wealth of this country in ancient times which is now a desert. Of all the mounds of which I have spoken, the most important after those of Bayat, Tchehar, is the one called Tepeh-Miziaw. It is composed of two distinct parts, the larger one or northern is surrounded by a rectangular wall. Everything in these ruins conveys the idea of a large city, even of a royal city surrounded by its suburbs and overlooked by the Akropolis. A long canal coming from the mountains, and yet at present well preserved, used to bring sweet water to the various parts of the city. Although I was not able to do anything more than ascertain the presence of those tells or mounds hurried as I was by the insecurity of the country I was crossing, I have no doubt that they must be ascribed to the very remote antiquity. Near one of them (Tepeh-Patak) I found a fragment of a limestone club, similar to those discovered at Susa, moreover the débris of bases and the general aspect of the ruins does not allow any other attribution. The natives call this plain Decht-e-Akhbar. These territories are successively occupied during winter by the Beni-Lams Arabs, the Seghvends, or by the Pouch-e-Kouh tribes, but there does not exist ony kind of village or dwelling. The Decht-e-Akhbar, most certainly played a very important part in the early history of the country; it was in the close vicinity of Susa, or the most direct and best road from this capital to Babylon. Between these two cities, via Bayat, the caravans would not journey certainly more than ten days, so it is easy to understand the care that the Anzan kings took to fortify it. Excavations there would be of the highest interest, but how could they be undertaken to-day, in a country where unceasingly circulate the offscourings of the

Louritan and Chaldea's people? These very brigands themselves would have to be employed as workmen! After having crossed rapidly this curious region, I arrived at Dizfoul on December 7, and at Susa on the 16th of the same month, and on December 18, 1897, the work was begun with the opening of a mining gallery.

COPPER-COATED ZINC PLATES FOR PROCESS BLOCKS.

COPPERED zinc plates combine the advantages of copper and zinc plates. They can be made as follows: An alkaline galvanic bath is first made containing—

Distilled water........	1,000 c. c.	1 ounce.
Copper acetate........	200 gms.	88 grs.
Ammonia........	100 c. c.	50 minims.
Potass cyanide.	500 gms.	220 grs.

The copper acetate is first dissolved, the ammonia added, and the precipitate which results dissolved in the potassium cyanide. An acid galvanic bath is likewise made by dissolving copper sulphate in water up to saturation.

The zinc plate to be coated is cleaned thoroughly with potash solution, and placed in the position of the cathode in the alkaline bath, a copper plate forming the anode. A current of about three amperes per square centimeter is used. After about five minutes, the zinc plate is removed and polished with chalk. The copper image is not affected by this treatment if conducted carefully. The zinc plates are next transferred to the acid bath, and submitted for about four minutes to the action of a current of about one ampere per square centimeter. If necessary, the plate, on coming from the second bath, is again polished.

Water............	100 c. c.	1 ounce.
Fish glue..................	20 gms.	88 grs.
Albumen..................	10 "	88 "
Ammonium bichromate...	3 "	13 "

The coating, drying, exposure and development of the plates is carried out as usual. The back and edges are then coated with asphalt varnish, and the plate is ready for the etcher.

The etching bath is a forty per cent. solution of ferric chloride which is allowed to act for about two minutes, a sufficient time to lay bare the zinc. The plate is washed well, cleaned by vigorous rubbing with a brush and pumice powder.

For the second etching a bath of three per cent. nitric acid is used for five minutes; this acts only on the exposed portions of the zinc. Should deeper etching be required, the plate must be inked in the usual way, powdered with asphalt, and heated. In this case, the etching bath may be five per cent., and the period of etching ten minutes.

If still further etching is desired, the plate is treated with a hard ink, and etched, not with nitric acid alone, but with the following mixture:

Water............................	100 vols.
Nitric acid..........................	5 "
Hydrochloric acid..................	15 "

in which the plate is kept for one minute. It is then prepared for the block.—G. Danesi, from Bulletino della Soc. Fot. Italiana, through Photographische Correspondenz.

A TRAINING-SHIP FOR THE MERCHANT MARINE.

THE passing of the sailing-vessel has had the effect of lowering the standard of seamanship. The constantly increasing size and cost of ocean liners necessitate the employment of officers and crews even more efficient than those who manned the old clippers. The difficulty of obtaining good seamen and officers has induced the North German Lloyd Company to fit out a vessel for the training of boys for its own merchant marine. Boys of 15 or 16 years of age, who wish to become officers, are to pass three years upon the company's schoolship. After having been thoroughly trained during this period they will have become full-fledged sailors. In order to fit them for their position as officers they will be taught navigation and other subjects by especially-appointed men. After completing the three years' course, the apprentice will pass a year as an auxiliary officer on one of the company's liners. After serving for a year in the imperial navy (for every German citizen must serve in the army or navy) he will be given the position of fourth officer. He will then be promoted to the rank of third officer after having passed a captain's examination, and will finally be entered as one of the company's staff.

Wheat for Edible Pastes.—Consul Covert writes from Lyons, January 9, 1900:

A large manufacturer to whom I sent a package of Texas wheat for examination writes me that macaroni and all forms of edible pastes can be made from it, but that the sample contains many grains of soft wheat which may prevent it from being quoted at a high price in the market. He thinks that if the Texas farmers would plant seed wheat from Taganrog, Russia, they would produce a very high grade for edible paste, and he would seriously consider a proposition to erect macaroni works in Texas.

No greater service could be rendered the farmers of Northern Texas than to forward them a quantity of good Taganrog wheat. I could obtain the same if desired.

American Horse Meat in Denmark.—Vice-Consul Blom writes from Copenhagen, January 16, 1900:

Several years ago I called the attention of the Danish dealers in horse meat to the American supply. I have now to report that the business is increasing rapidly, and the meat from the United States gives satisfaction. The consumption of horse meat in Denmark is comparatively large. Copenhagen is a distributing port for Sweden, Norway, Finland, Russia, and the German Baltic. Packers should address Levy Brothers, 31 Nybavn, Copenhagen: Krov & Madsen, 18 Nörregrade, Copenhagen. Mr. James Levy, of the above-named firm of Levy Brothers, is now on his way to the United States, and his address is care of the royal Danish consulate in New York city.

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